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BY

DR. ASHWELL, DR. CARPENTER, DR. GRAVES, DR. HENRY, DR. HUGHES, MR. KEY, MR. SCOUTETTEN, DR. STOKES, AND MR. TAYLOR.

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RESEARCHES

ON

THE STATE OF THE HEART,

AND THE

USE OF WINE IN TYPHUS FEVER.

BY WILLIAM STOKES, M. D., M. R. I. A.,[1]
Honorary Fellow of the King and Queen's College of Physicians, &c. &c. &c.

Before I enter on the investigations which form the basis of this paper, I may premise, that I consider typhous fever as an essential disease, not symptomatic of any known local lesion. To British readers this may appear unnecessary, as it is only the expression of opinions entertained by our most learned and experienced physicians. But as on the continent a different doctrine is held by some eminent pathologists, and as I have found it necessary to state to many continental physicians who have honoured the Meath Hospital with their presence, that we were opposed to the doctrine of localisation, I trust that the expression of these opinions will not be considered unnecessary or egotistical by my readers at home.

There can be no doubt that the typhus of Great Britain and Ireland is a disease of the whole system, not symptomatic of any particular local lesion; showing on the one hand a tendency to a favourable termination, after a period which varies indefinitely; and on the other, being capable of destroying life *with* various lesions, or *without* any appreciable change in the solids. It is a disease on which anatomy sheds but a negative light, not telling us what it is, but rather what it is not.

With respect to the organic lesions, I consider them as much secondary to the general disease, as the pustule in small-pox is to the disease of variola. Their not unfrequent absence in the worst cases of the disease proves that they are not the cause of typhus, while in cases where they do occur, we observe a signal want of proportion between their amount and the severity of the symptoms. They are in the fullest sense inconstant in their seat and extent,

[1] Dublin Journal of Medical Science, March, 1839.

incompetent to the explanation of symptoms, and unnecessary to the characteristic phenomena of the disease.

In making these observations I do not mean to throw the slightest doubt on the accuracy of those observations, which, accumulating for many years, have shown the singular frequency of intestinal ulceration in the fever at Paris and other situations on the continent. That there exists a much greater disposition to these forms of disease in those situations must be admitted, a frequency almost sufficient to justify the doctrine of the justly celebrated Broussais, that typhus was but a gastro-enteric irritation. But as my excellent friend, Dr. Staberoh, has well remarked, we must study disease in various countries before we come to any conclusions as to its nature. Had Broussais examined the typhus of Great Britain and Ireland, he would never have formed his theory of fever.[1]

If we compare the inexperienced man with him who has had a long continued practice in fever, we may often observe that the former employs a too vigorous antiphlogistic treatment in the commencement of the disease, and delays the exhibition of stimulants until the powers of life are sunk too low, while the latter is much more cautious in husbanding the strength of his patient, and shows much less fear of resorting to wine and other stimulants. It is in determining on the use of wine in fever that the junior or inexperienced man feels the greatest difficulty; it is in its exhibition that he betrays the greatest uncertainty and fear. This is to be explained by referring to the general character of the doctrines which have prevailed within the last quarter of a century, and which are only now beginning to yield to a more rational pathology. The doctrine of an exclusive, or almost exclusive, solidism, which

[1] Dr. Lombard, of Geneva, has lately endeavoured to show that the typhus fever of Ireland is a peculiar affection, differing from that of the continent in the absence of ulcerations. (See Dublin Medical Journal, vol. x. pp. 17, 101.) But the fact is, that intestinal ulcerations have been repeatedly observed in the typhus of Ireland, their amount and frequency varying with the epidemic influence. Of this we have abundant evidence in Doctor Cheyne's Reports. (See Dublin Hospital Reports, vols. i. and ii.) And in the epidemic of 1826 and 1827 we observed the follicular ulcerations (dothinenteritis of the French) in the greater number of cases. In many instances perforation took place, and the whole group of vital and cadaveric phenomena, corresponded almost exactly to the dothinenteric typhus of the French authors. The prominent symptoms were thirst, nausea, epigastric tenderness, vomiting, diarrhœa, and tympanitis, and in almost every dissection we found the ulcerated patches of the small intestine. Since then no severe or decided epidemic of fever has occurred, but cases of typhus are to be met with, with or without this peculiar lesion. The researches of Dr. Bright and the others in London, and of Dr. Staberoh in Glasgow, show, that ulcerations of the intestine occur not unfrequently in the typhous fever in these situations. We cannot then found any general distinction of British or continental fevers on this circumstance, the difference is in the degree of liability. This may be explained by local circumstances, and original dispositions inherent in particular races.

referred all diseases to visible changes of organs, which taught that inflammation was the first and principal morbid phenomenon, and that fevers were always the result, or accompanied with, some local inflammation, was, however disguised under various denominations, the doctrine taught to the majority of our students. Their ideas were thus exclusively anatomical; inflammation formed the basis of their limited pathology, and thus instructed, they entered on the wide field of practice, most of them having never even attended a fever hospital; utterly ignorant of the nature of essential fevers, they applied, in the diseases of debility, the treatment of acute local inflammation, and delayed stimulation until nature could not be stimulated.

Let it not be supposed that in this picture I seek to make a favourable contrast between the education which I myself received and that given to others. Far from it; I confess that it was not until several years after I commenced practice that I became fully aware of the erroneousness of what is termed the anatomical theory of disease; and I feel certain, humiliating though the confession may be, that the fear of stimulants in fever with which I was imbued, was the means of my losing many patients whose lives would have been saved, had I trusted less to the doctrine of inflammation, and more to the lessons of experience, given to us by men who observed and wrote before the times of Bichat or of Hunter.

The hospital physician will be frequently asked by students to state the principle on which he administers wine in fever, I conceive that the question may be thus answered. Typhous fever is a disease which has a tendency to a spontaneous and favourable termination, but one in the course of which the powers of life are attacked by a most malignant influence. By wine, food, and other stimulants, we support nature, until the struggle is past, so that, to use the words of an ancient author, which embody a more profound principle than appears at first sight, we "*cure the patient by preventing him from dying*;" that is to say, we prolong his existence until the natural and favourable termination of the disease arrives. We do not allow our patients to die of exhaustion, and bearing in mind the depressing influence they have to struggle with, we give stimulants at the proper time, and with a bold hand. We give our patients an artificial life, until the period arrives when nature and health resume their sway.

Yet, though we may admire the practice of an experienced physician in the use of wine in fever, it will often be found that he has a difficulty in expressing any exact reason for adopting the practice in a particular case. His practice is founded on a knowledge which is often incommunicable, an almost instinctive perception of the necessity for stimulation, characteristic of the great physician, and only to be obtained by a long and close familiarity with the disease. But is there any rule by which *the inexperienced man* can be guided; any one distinct phenomenon, the observation of

which is easy, and leading to an intelligible and communicable rule of practice? If the following statement of facts shall assist the inexperienced man in the treatment of a single case of fever, I shall feel more than rewarded, for I am convinced that it is to the fear of wine, or to ignorance of the principles of its exhibition, that we are to attribute the loss of many lives in the typhous fever of this country. I shall first speak of the influence of wine on the circulation in fever, and examine the phenomena of the pulse, the force of the heart, and the character of its sounds.

We have long observed, that when under the influence of wine the pulse became less and less frequent, the termination of the case was generally favourable, and as might be expected, the contrary result led to a bad prognosis. This practical observation I do not put forward as original, but I wish to express my great confidence in its truth.

Let us suppose a case of typhus on the tenth day of fever, and presenting severe symptoms of prostration, the pulse varying from 115 to 120. Wine is exhibited, and on the first day the pulse rises to 125, and on the second to 130, and if on the third day there is no diminution, we may make a bad prognosis; and thus the following rule may be laid down, that when, in a case where the symptoms seem to indicate wine, the pulse either does not come down, or increases in frequency under its influence, we may expect a bad result.

These facts naturally lead to the examination of the state of the heart in typhus fever, and the cases in this report are so arranged as to exhibit together the condition of the heart, and the amount of wine employed. *In this investigation we have sought for an additional rule, drawn from the state of the heart itself, to guide the inexperienced man in the exhibition of wine*, and I am not without hopes, that in the careful study of the cardiac phenomena, an indication hitherto unobserved will be obtained.

In typhous fever two opposite conditions of the heart may be observed; in the one the impulse becomes extremely feeble, or altogether wanting, while the sounds are greatly diminished in intensity; while in the other, the heart's action and sounds continue vigorous throughout the whole course of the disease.

These opposite states are not necessarily revealed by the state of the pulse or the warmth of the surface. We may observe a hot skin, while the action of the heart is almost imperceptible, and on the other hand a patient may be pulseless, cold, and livid for days together, while the heart is acting with the greatest vigour.

The condition of the heart must be determined by the application of the hand and stethoscope to the infra-mammary and sternal regions. Of this principle the following case is an illustration :—

CASE I.

Petechial typhous fever with extreme prostration—Failure of the pulse, and coldness of the breath and surface, with vigorous action of the heart—Liberal use of stimulants—Employment of transfusion of blood—Death—Absence of organic lesion.

A middle aged woman was admitted into our wards in February 1837, at an early period of her fever. She had attended upon and washed the clothes of a person who had died of a peculiarly malignant fever, yet on admission, and for several days subsequently, she presented no symptom beyond those of an ordinary and rather mild case of maculated typhus. From the first, however, she had a strong presentiment of death, which nothing could shake; she gradually became more and more collapsed; the surface was of a violet hue; the countenance sunken; and the skin and breath cold. From the eighth day no pulse could be perceived at the wrist, although the heart's impulse was strong, and the sounds remarkably distinct. She continued in this condition for some days, during which time stimulants of every kind were freely resorted to; on the fifteenth day, the surface being icy cold, but the heart still acting with vigour, while no evidence of organic disease could be found in the abdomen or head, I advised transfusion, which was performed by my colleague, Mr. Smyly. About six ounces of recently drawn blood were injected into the median basilic vein; a slight reaction followed, and the breath, which had been cold for several days, became warm. The pulse, however, did not return, and she died three days after the operation.

On dissection no organic lesion of any kind could be discovered in any part of the body; the heart was firm, and its muscular structure natural; no obstruction existed in any artery, but the whole quantity of blood seemed much diminished; the consistence of the blood was somewhat pitchy, and its colour very dark. The wound in the arm was still gaping, and did not present the slightest appearance of adhesion or inflammation.

This was certainly a rare form of fever, but, nevertheless, it establishes the point, that without any mechanical obstruction, we may have in fever, absence of the pulse, while the heart continues to act with vigour, and the case is one out of several which go to establish the conclusion to which I think we must arrive, *that a vigorous action of the heart in typhus* points out *that stimulants will not have so beneficial effect as in the opposite case.* I shall present other illustrations of this principle in the course of the paper.

I now recur to the division of cases of typhus into those with and those without altered phenomena of the heart. In the first class we observe:—

1. Diminution and ultimate cessation of the impulse.
2. Diminution of the intensity of the sounds.

3. Cessation of one of the sounds.

These phenomena, hitherto undescribed, are among the most interesting of those connected with the heart which I have ever observed, and I shall be able to show that they have a most important application in practice, as bearing directly on the question as to the use of stimulants in typhous fever.

I shall now present a series of cases observed particularly with reference to the heart. They are so arranged as to show first, the general symptoms; next, the phenomena of the heart and pulse; and lastly, the amount of stimulants employed.

CASE II.

Severe catarrhal typhus—Failure of the circulation—Cessation of the first sound of the heart—Use of stimulants—Recovery.

John Keefe, ætat. 20, of rather muscular frame, was admitted on the 11th of April, the seventh day of fever, with severe nervous symptoms, and all the signs, both vital and physical, of an intense bronchial affection, predominating in the left lung. The skin was thickly covered with bright red petechiæ, which were confluent, forming large patches on the arms and thighs; respirations 28, laboured; pulse 120, small and very weak.

The heart's impulse was visible, and the contractions audible, but the second sound greatly predominated over the first. It was loud and distinct, while the first was very feeble, particularly at the left side of the heart.

DATE.	GENERAL SYMPTOMS.	PHENOMENA OF CIRCULATION.	TREATMENT.
April 12.	Delirium; intense bronchial rales; insatiable thirst; diarrhœa.	Pulse 120, weaker than yesterday; impulse less perceptible; *first sound nearly inaudible;* carotid pulsations of good strength; extremities warm.	Cupping; blister to the sternum; anodyne enema, and poultices to the belly.
" 14.	Continual moaning; petechiæ more diffused, and dark coloured.	Pulse about 112; impulse barely perceptible; over the left cavities the first sound is scarcely distinguishable, while over the right it is more so; *second sound very clear.*	Wine 10 oz. arrow root, decoct. senegæ.
" 15.	Countenance improved; much delirium; bronchitis lessened; diarrhœa continues; the marks of the cupping glasses are black.	Pulse 112, contracted and compressible; no impulse of the heart under the mamma; the first sound totally inaudible, second less distinct than yesterday, on the left margin of the sternum nothing can be heard but the second sound, and this feebly.	Wine 16 oz. Blister to abdomen; anodyne enema; beef tea.
" 16.	Looks better; slept well; diarrhœa less.	Pulse 108, stronger and fuller; first sound audible over the whole præcordial region, second more distinct.	Repeat all.

DATE.	GENERAL SYMPTOMS.	PHENOMENA OF CIRCULATION.	TREATMENT.
April 17.		Pulse 100; respirations 28; impulse again perceptible.	Wine 12 oz.
" 18.		Impulse still stronger, striking over a greater surface; both sounds distinctly audible at the inferior part of left side, and also to the right of the sternum; pulse 96; respirations 32.	Wine 12 oz.; jelly 2 glasses.
" 19.	Bronchitis much less; petechiæ fading; bowels regular.	Pulse 76, full, of good strength; heart's impulse more vigorous; sounds as yesterday.	Wine 6 oz.
" 20.		Pulse 88; phenomena of heart natural.	Wine 6 oz.
" 21.		Ditto, ditto.	Wine 4 oz.
" 23.	Convalescent. Patient discharged on 2d May, perfectly well.		

In this case, and that which follows, we observe the remarkable and important peculiarity of the supervention of bad symptoms of prostration and putrescence at an unusually early period of the disease. This circumstance should always excite great apprehension, and lead to the exhibition of stimulants, notwithstanding the existence of various local irritations. In both these cases the chest and abdomen were severely engaged, and in both the early exhibition of wine not only did no harm, but was productive of the happiest effects. The existence of signs of bronchitis or enteritis in our maculated fever does not necessarily contra-indicate the free and early use of stimulants.

In examining the efficacy of wine in typhus, if we compare the cases with predominance of enteric, and those with bronchial irritation, we generally find that in the latter group the stimulant is better borne, and there is a class of cases in which wine is scarcely admissible. These cases present signs of enteric irritation of great severity, alternating with violent nervous symptoms, unaccompanied by petechiæ, or other phenomena of putrescence. The use of wine is almost always injurious from its too violently exciting the brain. But in the bad petechial typhus with great prostration of strength, the existence of thirst, abdominal pain and tenderness, diarrhœa and tumefaction, should not prevent us from having recourse to wine.

I beg to draw the particular attention of my readers to the cardiac phenomena in this case; it may be right to state, that the stethoscopic observations in this and the succeeding cases were made with the greatest care.

We observed, in the first place, a progressively diminishing

impulse; on the seventh day the impulse was visible at the side, but on the tenth was altogether wanting; it reappears on the twelfth, and continues to increase until the period of the patient's restoration to health.

In the second place we find a singular modification of the sounds of the heart; the proportion between the two sounds was lost on the seventh day, the first being exceedingly feeble, the second comparatively strong; on the eighth day the first sound was scarcely audible, and on the tenth it became extinct, and we had the singular phenomenon, never before observed, of the heart in typhous fever giving but a single sound. On the eleventh day, under the influence of powerful stimulation, the first sound reappears, and the second has more vigour; on the twelfth day both sounds are distinctly audible, and on the fourteenth the phenomena of the heart are natural.

We shall not here enter into speculations as to the cause of these phenomena, but proceed with a detail of facts.

CASE III.

Severe maculated fever, delirium, diminution of the first sound of the heart —Use of wine in large quantities—Recovery.

Patrick Quin, æt. 20, was admitted on the 27th of February. It was stated that he had been ill but five days, but his appearance was that of a person after a much longer period of fever; he was collapsed, cold, and stupid, and covered with an abundant crop of dark livid maculæ; prostration extreme; eyes suffused; tongue covered with brown sordes; pulse 125, small and weak; heart's action feeble; respiration hurried. He was ordered four ounces of wine.

DATE.	GENERAL STATE.	PHENOMENA OF CIRCULATION.	TREATMENT.
Feb. 28.	Violent delirium during the night; he is now in a state of collapse, lying on his back; constant jactitation; subsultus: cold extremities; retention of urine.	Pulse 132, soft, small, and variable; heart's impulse imperceptible; sounds defined; the pulsations in the carotids very feeble.	Wine 24oz. blister to the head, turpentine enema.
March 1.	Slept well; in other respects is nearly the same, but is more easily roused; less suffusion of the eyes; considerable subsultus; he passed urine involuntarily.	Pulse 120, a shade stronger than yesterday; the *sounds of the heart are quite similar to those of the fœtal circulation.*	Wine 24oz. turpentine enema.
" 2.	Slept well; tongue moist; respirations 30; maculæ fading; extremities warm.	Pulse 130, fuller and stronger; heart's action stronger, and sounds much louder—they approach to their natural character.	Wine 14 oz.

DATE.	GENERAL STATE.	PHENOMENA OF CIRCULATION.	TREATMENT.
March 3.	Violent delirium through the night; skin hot; bowels confined.	Pulse 104; heart's impulse stronger.	Wine 12 oz. enema.
" 4.	No change; great thirst.	Pulse 106.	Wine 12 oz.
" 5.	Patient worse; countenance more collapsed; violent delirium; picking of bed-clothes; subsultus; sighing; contraction of the pupils: incontinence of urine; skin hot and dry; mouth covered with black sordes.	Impulse of the heart plainly perceptible; *second sound* much louder than the first: pulse 120.	Wine 16 oz. Turpentine draught, with camphor, musk, and opium mixture; beef tea; swathing with flannel.
" 6.	Generally improved; slept well; much more sensible.	Pulse 106.	Wine 16 oz.
" 7.	Complains of great thirst; extremities warm; maculæ bright red, and less abundant; pupils natural; tongue moist.	First sound of heart much stronger; pulse 96.	Wine 16 oz.
" 8.	Great improvement; desire for food; skin cool.	Heart's action nearly natural; second sound much improved; the abdominal aorta can be felt throbbing with force.	Wine 16 oz.; omit mixture.
" 9.	Skin cool; slept well.	Impulse of heart vigorous; strong action in the arteries of the neck and abdominal aorta; pulse 88, strong and full.	Omit wine.
" 12.	Convalescence perfect.	Sounds and impulse of heart natural; pulse 72.	Full diet.

In this case, as in the one preceding, we observe the *early supervention* of bad symptoms, producing the same necessity for early stimulation. Indeed it has rarely happened, that we were obliged to exhibit so large a quantity of wine on the fifth day of the disease, and I am convinced that nothing else would have saved the patient's life. It is impossible to lay down any rule, as to when the exhibition of wine should be commenced in our typhus, but the point must be regulated, much less by the date of the fever, than by the actually existing condition of the patient. The circumstances which lead to its exhibition on the fifth day were the great collapse, the colour of the petechiæ, the coldness of the extremities, and the feebleness of the heart; on the following day the symptoms pointed out the necessity of a great increase of the stimulants; the prostration was increased; the rapidity of the

pulse augmented, *while the impulse of the heart had become imperceptible.* In two days after this a distinct improvement commenced. Yet, though phenomena of reaction showed themselves, the wine was continued, though in diminished doses, to the fourteenth day of the disease, and for the last three days its exhibition was combined with that of camphor, musk, and opium. The latter remedies were resorted to from the increase of the nervous symptoms on the eleventh day. The pulse on the day previous had been 106, it rose on the eleventh day to 120; it fell on the following day to its former standard, after which it gradually subsided to its natural rate.

In most cases in which wine is found to answer, the pulse comes down under its influence gradually and steadily; this I have before alluded to. In a few, however, we observe remarkable variations in the rapidity of the pulse. Of this the preceding case is an example; the increase of pulse, however, was met not by an augmentation of the wine, but by the exhibition of nervous medicines, which were productive of the happiest effect. Beef tea was also given, and the patient swathed with flannel, a measure of the greatest importance and value in the treatment of fevers with collapse, or with a tendency to bronchitis.

As connected with the rising of the pulse in typhus, the following rules with reference to the use of wine will be often found applicable:—

1st. That the increase of rapidity is almost always an unfavourable symptom.

2d. That when it occurs at an early period of the disease with a cool skin, and dark-coloured eruption, it is to be met by an increase of wine.

3d. That when it occurs in the latter period, accompanied by severe nervous symptoms, the patient using wine freely, we must carefully support the system, and exhibit, in conjunction with the wine, musk, camphor, and opium.

On the seventh day, in this case, the impulse and sounds of the heart were remarkably modified, the first was singularly diminished, and the sounds assumed characters closely resembling those of the fœtal heart; this modification is not very common in typhus. In most cases one of the sounds is much more influenced than the other, the proportion between them is thus greatly altered, and there is no resemblance whatever to the sounds of the fœtal circulation. But when there is a great diminution of the intensity of both sounds, and the pulsations vary from 125 to 135 in the minute, the sounds exactly simulate those of the fœtal heart. In this instance the proportion between the sounds was lost on the eleventh day, the first being exceedingly feeble, the second comparatively louder; this character disappeared on the thirteenth day, when the first sound regained its natural character, and it is a most interesting fact, that on the following day the second sound was observed to be exceedingly loud, while the abdominal aorta was throbbing with force.

I shall state the order of occurrence of the cardiac phenomena in this case.

1. Diminished impulse.
2. Impulse imperceptible.
3. Sounds of heart equally diminished (fœtal character).
4. Impulse and sounds stronger.
5. Second sound proportionally louder than the first.
6. First sound stronger.
7. Sounds and impulse natural.

We shall hereafter show the importance of these observations, as bearing on the theory of motions and sounds of the heart.

CASE IV.

Maculated typhus—Absence of the first sound of the heart—Extreme slowness of the pulse during convalescence—Use of wine in large quantities—Recovery.

Matthew Hickey, æt. 30, was admitted into hospital on the 15th of July, having had fever six days. Had been in the habit of drinking, but never to excess; he is the fifth of his family who has had severe maculated typhus; at present his countenance is much flushed; eyes suffused; maculæ abundant and of a bright red colour; tongue covered with a dirty brown fur, especially at the sides; great abdominal tenderness, particularly in the region of the liver. The chest, on percussion, yields a clear sound, and there are no stethoscopic indications of disease in either lung; the impulse of heart is not perceptible; although both sounds are audible, the second is heard to preponderate distinctly; pulse 124; respiration easy and natural; bowels free.

He was ordered—℞. Solut. bicarb. ammoniæ, ʒviii.; acet. morphiæ, gr. ¼; tinct. hyosciam. ℈i. Ft. mist. efferv. Capiat coch. amp. ii. tertiis horis.

DATE.	GENERAL SYMPTOMS.	PHENOMENA OF CIRCULATION.	TREATMENT.
July 16.	Slept well; bowels regular; tongue thickly coated and dry; convulsive respiration; skin pale and very clammy.	Impulse of the heart is quite imperceptible, even when he lies on the left side; to the *right of the left nipple the second sound alone is audible;* pulse 120, rather feebler; on sitting up the impulse is not rendered more evident.	Wine 12 oz., blister over the heart, beef tea.
" 17.	There is still some abdominal tenderness; slept pretty well; respirations 28; interrupted by frequent sighing, and partaking of the cerebral character. He got altogether yesterday 20 oz. of wine and a little brandy.	The impulse is felt at the apex, but the sounds are by no means in proportion to its vigour; they resemble those of the fœtal heart; between the fifth and sixth ribs the sounds are barely audible.	Wine 24 oz., two glasses of brandy, arrow root, blister to the scalp; enema emolliens.

DATE.	GENERAL SYMPTOMS.	PHENOMENA OF CIRCULATION.	TREATMENT.
July 18.	Very restless; has not slept; frequently rises from his bed; passes water freely; tongue red at the edges, and covered in the centre with dark brown fur; teeth coated with black sordes; lies on his back in a semi-stupified state; countenance collapsed and pale; maculæ very livid; respirations 32; on the back there are a few ecchymotic patches; abdominal tenderness continues.	The sounds of the heart very feeble; the first almost inaudible, the second is loud and clear, and at a point central between the nipple and sternum, this is much more marked; the impulse can only be felt when the fingers are placed between the intercostal spaces.	Wine 24 oz., poultices to the abdomen.
" 19.	Skin cooler, moistened with perspiration; the respiration although laboured has lost its cerebral character; the ecchymotic patches are fading; tongue cleaner; abdominal tenderness less; is more animated.	Pulse 116; impulse of heart the same as yesterday, the first sound is entirely absent, the second is distinct.	Wine 24 oz., blister and poultice to the epigastrium.
" 20.	The countenance has lost the peculiar typhoid expression; the petechiæ are fading; breathing still laboured.	Impulse of the heart quite imperceptible; the first sound is just audible; pulse 96.	Wine 18 oz.
" 21.	Passed a restless night; breathing much easier. He is quite sensible.	Pulse 80, and of good character; the sounds at the upper portion of the chest are proportionate but feeble; at the apex, and nearer the ensiform cartilage, the second sound still predominates.	Wine 12 oz.
" 23.	Countenance more animated; skin cool; maculæ almost gone; complains of thirst; passes large quantities of pale-coloured urine.	Pulse 76; impulse of the heart perceptible; sounds proportionate.	Wine 6 oz. Haustus Rhei.
" 24.		Pulse 76.	Wine 6 oz.
" 26.	Sleeps well; appetite good; petechiæ gone.	Pulse 60; of very good strength.	Wine 6 oz.
" 28.		Pulse 50.	Wine 6 oz.
Aug. 1.	Is allowed to sit up during the day; is not fatigued; appetite very good.	Pulse 32; counted most carefully twice over.	Gets bread and milk.
" 4.	Feels perfectly well.	He is sitting up in bed, and the pulse at this time is 32.	As yesterday.

DATE.	GENERAL SYMPTOMS.	PHENOMENA OF CIRCULATION.	TREATMENT.
Aug. 6.		He is now eating his breakfast; pulse at this moment 56.	

Discharged in a few days. Pulse 60.

This case was one of extreme interest; the severity of the symptoms, the quantity of stimulants used, and the remarkable modifications of the heart's action, all combined to render the patient an object of the greatest attention to the class.

The diminution of the first sound of the heart was the circumstance which led to the exhibition of stimulants boldly, at an early period of the case. We observed that on the seventh day the impulse was imperceptible, and the first sound was diminished. On the eighth, the first sound had disappeared, and although the other symptoms did not seem to call for active stimulation, we ordered wine in free doses from this indication alone, and the result justified the treatment. Here was a case of a young man of a good constitution, in which, from studying the action of the heart, we were able to anticipate the symptoms of general prostration, and by the early and bold use of wine, to prevent the fatal result which, it is almost certain, would otherwise have occurred.

The order of the succession of the cardiac phenomena in this case was peculiar. We had

1st. The early subsidence of the first sound.

2d. Both sounds audible, but with the fœtal character.

3d. Predominance of the second sound.

4th. Complete absence of the first sound.

5th. Impulse imperceptible, with returning first sound.

6th. The sounds at the base of the heart proportionate, while at the apex the second predominates.

7th. The sounds natural.

The pulse, too, presents some interesting points for consideration. Within a period of twenty days its rate was as follows:

7th	day of	fever . .	124
8th	"	" . .	120
11th	"	" . .	116
12th	"	" . .	96
13th	"	" . .	80
15th	"	" . .	76
17th	"	" . .	60
18th	"	" . .	50
22d	"	" . .	32
27th	"	" . .	56

In a few days it rose to 60.

Laennec has suggested, that the rapidity of the pulse observed during the convalescence of fevers might depend on a softened condition of the heart. As I shall have occasion to notice his opinions on the state of the heart in typhous fever at greater length presently, I shall merely observe, that in those cases in which the pulse con-

tinued rapid during convalescence, the fever was seldom of the petechial or putrid character; and one of the most remarkable phenomena in our fevers during the last year, was the return of the pulse to its natural rate, even before the whole group of typhoid symptoms had disappeared; and so far from a quick pulse being common *during the convalescence* in cases which had shown the signs of putridity, we found more frequently a singular slowness continuing for several days, until the patient was able to leave his bed.

CASE V.

Maculated fever—Great feebleness of the heart's action—Free use of wine —Convalescence on the seventeenth day.

Bryan Kean, æt. 24, of strong muscular development, was admitted on the 25th of March, having been then nine days ill: his countenance is dull, stupid, and of a livid hue: eyes heavy and suffused; he is in a state of great stupor and prostration; decubitus on the back. Skin hot, dry, and covered with small livid petechiæ; tongue fissured, brown, and parched; has great thirst, and suffers much pain from pressure on the epigastrium; respirations 40, not laboured, and a few bronchitic râles can be heard in the left lung; the pulse 120, small and weak; the heart's impulse almost imperceptible, and the first sound so feeble as to be inaudible to the left of the mamma, but it can be distinguished between the mamma and sternum. Ten leeches were ordered to the epigastrium, turpentine enema, artificial heat to the extremities, and eight ounces of wine.

DATE.	GENERAL SYMPTOMS.	PHENOMENA OF CIRCULATION.	TREATMENT.
	Slept well; countenance more livid; thirst insatiable; teeth covered with sordes; epigastrium less painful; extremities perfectly livid and cold.	Pulse 116, small and weak; impulse of the heart quite imperceptible: sounds are exceedingly feeble, they are almost inaudible below and to the left of the mamma, so that it is very difficult to distinguish between the first and second sounds, the sounds as it were running one into the other; between the mamma and sternum they are stronger, and better defined; the second is much clearer than the first. If the rapidity of the heart was a little increased, nothing could more closely resemble the fœtal circulation.	Wine 16 oz.
	Continued raving; involuntary evacuations; countenance improved; extremities cold and livid.	Pulse 92, small but distinct, stronger, and perfectly regular; the action of the heart can be seen between the fifth and sixth ribs, but can scarcely be felt; sounds of the left side remain as yesterday, those of the right are more distinct.	Repeat wine.

DATE.	GENERAL SYMPTOMS.	PHENOMENA OF CIRCULATION.	TREATMENT.
March 28.	Continued low muttering delirium; great prostration; involuntary passage of urine; extremities very cold, notwithstanding the use of artificial warmth; petechiæ livid; respirations 24; intelligence improved.	Pulse 84; impulse of heart less perceptible, but the first sound has more vigour.	Wine 16 oz., musk, camphor, and ammonia mixture; two glasses of jelly.
" 29.	Great improvement; extremities warm; petechiæ of red colour; tongue cleaning; slept well; respirations 20.	Pulse 84, firmer and steadier; when he lies on the left side the impulse of the heart is very perceptible, when on the back it is less so, but more evident to the touch than on yesterday; sounds increased in strength and distinctness.	Wine 12 oz., omit mixture; to have beef tea.
" 30.	Improvement continues, but the lower extremities are liable to become cold when the artificial heat is removed the urgent thirst remains; tongue still brown.	Pulse 72, fuller and stronger; pulsations of the arteria innominata are distinctly visible at the top of the sternum; impulse of heart as before, but the sounds have improved in strength.	Wine 8 oz., beef tea.
April 1.	Convalescent.	Pulse 72, full and compressible; heart's sounds strong and natural.	Wine 4 oz., beef tea and chicken broth.
" 2.	Do.	Do.	Omit wine.

We have here another case in which we were led to the use of wine on the ninth day of fever, almost wholly from the observation of the phenomena of the heart. Although the case had a generally bad aspect, yet I do not think that I would have been so bold in the exhibition of wine had the patient been admitted before these researches had been commenced. There were many circumstances which seemed to contra-indicate wine: the patient was a young and robust man; his skin was hot and dry; his tongue brown and parched; he had extreme thirst, and great tenderness of the epigastrium. Some years ago I would not have dared to have given this man wine, from the apprehension of its increasing gastric inflammation. On the other hand, he had great prostration, and the petechiæ were of a livid hue: but it was on the cardiac signs that we relied; we had new and positive guides, and they did not deceive us.

I greatly doubt whether there is any symptom which we can depend on as indicative of gastric inflammation in petechial typhus. That the condition of the tongue is fallacious has been established by Andral and Louis from numerous dissections, and the utility of wine and other stimulants, when the tongue is dry and brown, gives another and different description of proof. In a paper on the use of wine and opium in fever, published by my colleague, Dr.

Graves, in the first volume of the Dublin Journal of Medical Science, he observes: "In the first place, as to the tongue, *at an advanced* period of fever, I have often derived the greatest advantage from wine and opium, although the tongue was dry, the colour of old mahogany, or else coated with a yellowish brown dry fur, and protruded with difficulty, while the teeth and gums were covered with sordes; wine or porter, in moderate quantities, seem generally to agree with this tongue better than opium; in some cases, however, the latter is indispensable. For fear of misleading the reader, I must again remark that I by no means wish to assert that such a tongue uniformly, or even frequently, indicates the use of these medicines: on the contrary, this state of the tongue and mouth will often be observed at a time when leeches and the antiphlogistic treatment are required. Let it be clearly understood, however, that at an advanced period of fever this state of tongue may exist, and yet wine and opium may be given boldly, provided, as I have said before, the general state of the patient seems to require it."

Let it be recollected that in this case we had the symptoms of a dry and brown tongue, great thirst, epigastric tenderness, and heat of skin. On the first day of treatment leeches were applied to the epigastrium, and wine exhibited to the amount of eight ounces. I have frequently leeched the epigastrium, and ordered wine on the same day, and with benefit. In our case the epigastric tenderness was lessened, but the thirst continued insatiable: the quantity of wine was doubled. Two circumstances led to this, one the extreme coldness and lividity of the extremities; and the other, the increasing indications of debility of the heart, as shown by the great indistinctness of the first sound, and the approach of the stethoscopic phenomena to what we term *the fœtal character.*

On the third day of the use of wine, and eleventh of the disease, the pulse fell from 116 to 92, and the first sound began to recover its natural intensity: this change was first *perceived over the right cavities of the heart.* This curious fact I have repeatedly observed, and I think it may be stated, that in all cases in which the first sound is lessened or obliterated, the return to the natural character is first perceived over the right side of the heart. Whatever be the cause of these interesting phenomena, it seems much more to engage the arterial than the venous side of the heart.

CASE VI.

Maculated typhus, with diminution of the first sound of the heart—Use of wine and brandy.

John Smyth was admitted into the Meath Hospital on the 19th of May; the tenth day of his fever. He is a strong, powerful man; has been accustomed to drink ardent spirits, but was not very frequently intoxicated; at present is very low: he was last night constantly getting out of bed; passes his water under him; the

petechial eruption is thickly diffused over his body: tongue dry, and red in the centre; intellect this morning clear; pulse 124, very small, and easily compressed; the impulse of heart feebly perceptible; the first sound very indistinct, the second clear; above the mamma the first sound is scarcely audible. Ordered wine ℥viii.

DATE.	GENERAL SYMPTOMS.	PHENOMENA OF CIRCULATION.	TREATMENT.
May 20.	Passed a good night, did not rave; respirations 36; retention of urine; extremities cold.	Impulse of the heart imperceptible, second sound predominates over the first; pulse 124.	Wine 12 oz., glass of hot brandy punch.
" 21.	Slept well, no raving; petechial eruption livid: eyes suffused; respirations 36; tongue cleaner; retention of urine continues, requiring frequent use of the catheter; bowels regular; bronchitis very acute.	Pulse 112; the impulse of the heart is perceptible when he lies on his left side; the second sound predominates considerably over the first.	Wine 12 oz., dry cupping to chest extensively; blisters to the region of the heart.
" 22.	Had some sleep, no raving; countenance improved; eyes less suffused.	Pulse 100, full and regular, *whereas before the additional quantity of wine given yesterday it was intermitting*; sounds of heart feeble, second still predominates.	Wine 20oz. In consequence of his low state he was given 8 oz. of wine additional yesterday; beef tea one pint; pulv. ipecac. gr. ½; ammon. carb. gr. ii., ft. pil. ter die sumend.
" 23.	Passes his urine and fæces under him; respirations 32, not so laboured; extremities warmed by artificial heat; great prostration.	Pulse 84, small; the impulse of the heart is more distinct to-day; the first sound is still below par.	Wine 20 oz., beef tea 1 pt., jelly, a glass; blisters over the heart and nape of neck.
" 24.	Countenance much improved; slept well; when he is raised in bed he complains of lightness of his head; bronchitis considerably better.	Pulse 80; impulse of heart perceptible, the first sound is stronger.	Wine 20 oz.
" 25.	Passes his urine freely; had a quiet night; is much better.	Pulse 80, very good strength; impulse of the heart natural, sounds proportionate.	Wine 16 oz.
" 26.	Scarcely any cough; sleeps well.	Pulse 70, regular; phenomena of heart as in last report.	Wine 16 oz.
" 27.	Sat up yesterday; is still a little nervous.	Pulse 72.	Wine 6 oz.

DATE.	GENERAL SYMPTOMS.	PHENOMENA OF CIRCULATION.	TREATMENT.
" 28.		Pulse 72; sounds and impulse of heart perfectly natural.	Wine 6 oz.
" 29.	Convalescent.		

CASE VII.

Maculated fever, with severe gastro-catarrhal and nervous symptoms—Remarkable modification of the heart's action—Use of wine.

Thomas Cavanagh, æt. 15, was admitted on the 14th of April, being then three days ill: he had a few indistinct pale spots on the back; excessive thirst; diarrhœa, and tenderness of the epigastrium: there was slight cough, with abundant frothy mucous expectoration. Pulse 120, small and easily compressed; but the impulse of the heart is strong, and the sounds distinctly heard over a large portion of the chest. The epigastrium was leeched, and effervescing draughts ordered.

DATE.	GENERAL SYMPTOMS.	PHENOMENA OF CIRCULATION.	TREATMENT
April 16.	General symptoms continue; respirations 32.	Pulse 126; impulse of heart not so strong.	Four leeches to the epigastrium; enema emolliens.
" 17.	Maculæ more distinct; the abdominal symptoms continue; respirations 36; some delirium.	Pulse 120, weaker; impulse of the heart scarcely visible, but is quite perceptible to the touch; sounds are natural.	Hip bath; poultice to the abdomen.
" 18.	Copious sweating after the bath; he is worse this morning; constant low delirium; countenance pale and depressed; less heat of skin; maculæ abundant, and becoming livid; tongue dry, brown; great thirst; considerable tenderness in the ileocæcal region.	Pulse 132, still weaker; impulse of heart can be seen and felt; the sounds are exceedingly weak, *particularly the first, which is scarcely audible.*	Eight leeches to the abdomen; small doses of hydrarg. c. creta and Dover's powders.
" 19.	Debility increased; skin hot and dry; petechiæ universally abundant, and of a dark livid hue; respirations 30, less laboured; great thirst.	The sounds of the heart exactly resemble those of the fœtus at the eighth month; an exceedingly indistinct impulse can be felt at the end of expiration.	Wine 3 oz.; arrow root.
" 20.	Slept better, less raving; countenance improved; eyes less suffused; abdominal symptoms continue; respirations 28, interrupted by frequent sighing; sonorous and sibilous rales in posterior portion	Pulse 140, slightly improved in strength; impulse of heart more perceptible, and its sounds can be heard to the right of the sternum.	Wine 3 oz; arrow root.

DATE.	GENERAL SYMPTOMS.	PHENOMENA OF CIRCULATION.	TREATMENT.
	of the chest; two small gangrenous spots on the left ear.		
April 21.	Slept well, and is more collected; complains of extreme thirst; respirations 32; skin hot and dry; maculæ unusually abundant, and livid; one of the ecchymosed spots on the ear has vesicated; extremities warm.	Pulse 132, fuller, more firm; impulse of heart as yesterday, but the sounds to the right of sternum are not so distinct, particularly the first, which is remarkably feeble.	Wine 5 oz.
" 22.	Symptoms as before; respirations 40.	Pulse 125; no change in the heart.	Wine 5 oz.; repeat rest.
" 23.	Raving continues; skin cooler; maculæ not so livid; cough worse, with much stuffing.	Pulse 135. When he lies on the left side, the impulse of the heart is strong, first sound more distinct.	Wine 5 oz.; fetid enema.
" 24.	The typhoid expression quite gone; eye clear and sprightly.	Pulse 110, soft and much improved; impulse and sounds still stronger.	Wine 5 oz.; Ipecac. & carb. ammonia in pills.
	Convalescent.		

The two preceding cases exhibit still the same phenomena, the diminution of the impulse of the heart and of its sounds, particularly the first. In the case of Cavanagh, we observed the change from the natural to the morbid condition, for the patient was admitted at an unusually early period of fever. In that of Smith, the first sound of the heart was altered on admission. In bad cases, the alteration of the sounds may be expected on or about the fifth day. The change does not seem to be accompanied by any peculiar disturbance of the circulation. *We have as yet recorded no evidences, physical or vital, of a local irritation accompanying or preceding the diminution of the first sound;* and our dissections and those of Louis agree as to the absence of the usual appearances of carditis.

In the case of Smyth, the quantity of wine employed was much greater than in that of Cavanagh; for this there were several reasons: the greater age of the patient, and his having been addicted to ardent spirits being the principal: besides, we could not tell how long the morbid condition of the heart had existed before admission; and it was acting on the safe side to assume that it had continued for several days, a circumstance which would indicate great activity in stimulation.

In the fevers of children, and of persons but a few years beyond puberty, the necessity for the use of wine is seldom so urgent as in those beyond twenty, or twenty-five; but we have had several cases of maculated typhus in children, with such prostration as to demand

a free use of wine, which had the best effect, notwithstanding the existence of what we consider local inflammations.

CASE VIII.

Maculated fever; with signs of bronchitis and enteritis—Purulent discharge from the nose—Great prostration—Use of wine—Recovery.

Henrietta Wright, æt. 13, was admitted on the 9th of April, after having been in fever upwards of a fortnight; her countenance was collapsed; the face livid; nocturnal delirium; violent headach, with a copious purulent discharge from the nostrils; extreme thirst; she was constantly sobbing and moaning; skin hot, and covered with an abundant crop of small livid maculæ. Intense bronchitis, unaccompanied by expectoration; complains of pain on pressure of the epigastric region; pulse 120, exceedingly feeble; impulse of heart extremely weak, and more distinct with the second than the first sound; the second sound is very clear, the first scarcely audible; it is more distinct over the right than the left side. Ordered, wine 4 oz., blister over the epigastrium, and ipecac. and pil. hydrarg. four times in the day.

DATE.	GENERAL SYMPTOMS.	PHENOMENA OF CIRCULATION.	TREATMENT.
April 11.	Low muttering delirium; eyes suffused; countenance depressed; tenderness of epigastrium increased; pain referred chiefly to forehead; mucous expectoration, with troublesome cough; bowels not opened since yesterday; respiration 46, hurried.	Pulse 125, very feeble; impulse of the heart as yesterday; first sound improved.	Wine 4 oz.; blisters to the head and legs; ice to the temples; turpentine enema; arrow root; barm.
" 12.	General improvement at 4 o'clock P. M.; yesterday her pulse was imperceptible, and extremities cold. Bronchial rales intense over the whole chest; discharge from the nose less profuse; cough troublesome; expectoration copious.	Pulse 120, stronger and fuller; sounds of the heart are more distinct; impulse can be felt.	Wine 4 oz.; chicken broth; flannel waistcoat.
" 13.	No improvement; constant sobbing; headach; abdomen hard, full and very tender; bronchitis continues intense and general; respirations 48.	Pulse 110; heart's action more vigorous.	Wine 4 oz. Blister between shoulders; poultice to the belly; chicken broth.
" 14.	The catarrhal and nervous symptoms continue; she is continually turning up her eyes; respirations 40, convulsive and hur-	Pulse 105, stronger than yesterday; impulse can be felt, but the sounds are masked by the bronchial rales.	Repeat cataplasm. abdom.

DATE.	GENERAL SYMPTOMS.	PHENOMENA OF CIRCULATION.	TREATMENT.
	ried, accompanied with sobbing; abdomen exquisitely tender; face more livid.		
April 15.	She is much improved, maculæ indistinct; abdomen still very tender; secretion from the nose has ceased; respirations 40.	Pulse 110.	Repeat all.
" 16.	Improvement continues; abdominal tenderness nearly gone; lividity has disappeared; respirations 50, yet not laborious; musical and crepitating rales predominating in left lung, which is clear on percussion.	Pulse 108; impulse and sounds more distinct.	Wine 4 oz.; antimonial solution.
" 17.	General improvement; respirations 55; *perfectly easy.*	Pulse 84, soft and full.	Wine as before.
" 21.	Complete convalescence.	Pulse 56.	Do. do.

In this case, the circumstances which might seem to contra-indicate the exhibition of wine were, that the patient was not yet arrived at the age of puberty, the heat of the skin, and the violent symptoms of abdominal and thoracic irritation. On the other hand, she had been upwards of a fortnight ill; had a collapsed countenance; the petechiæ were livid, and the first sound of the heart scarcely audible. To these indications must be added that of the purulent discharge from the nose, a symptom not by any means common, but one which doubtless pointed out a necessity for stimulation. I have seen this symptom in but two cases of typhous fever; it is a very peculiar, and in my opinion, alarming one. The pus runs from the nostrils in a copious and continued stream; the nose is somewhat swelled, and the patient lying on the back, and in extreme prostration, presents a close resemblance to an individual labouring under glanders.

It will be observed that on the 16th of April the antimonial solution was ordered: this was done with the view of relieving the bronchial irritation; its exhibition, however, at this advanced period of the case involves a point of practice of great importance, namely that in certain cases the typhoid symptoms prevent us employing an antiphlogistic treatment for many days; a change then takes place, and the patient will bear a reducing treatment for the relief of local disease, which before would have been dangerous: to this I shall hereafter return. It will be seen, in the case under consideration, that while the antimony was ordered the wine was not discontinued.

Great advantage was obtained by poulticing the abdomen in this

case; I have the greatest reliance on this treatment in the secondary abdominal irritations of fever. It was, I believe, first recommended by Broussais. It is particularly advantageous where the weakness of the patient forbids the use of leeches.

In the same class of cases, my friend Dr. Lees has treated a great number of patients by the use of the hip bath. For the success of this treatment, in many of his cases, I can vouch; and to his judgment, in the management of the remedy, I can bear full testimony.

CASE IX.

Petechial Fever, with Bronchitis; Diminution of the First Sound of the Heart; Use of Wine; Recovery.

Thomas Wallace, admitted on 10th May, eleventh day of his fever, complaining of intense headach; general eruption of petechiæ; the sounds of the heart were feeble, but proportionate; impulse imperceptible; pulse 98, full but easily compressed. Ordered wine 8 oz., Mist. Camph. c. Carb. Ammon.

DATE.	GENERAL SYMPTOMS.	PHENOMENA OF CIRCULATION.	TREATMENT.
May 11.	Pupils contracted; countenance flushed; decided bronchitic rales.	Impulse of heart just perceptible; the sounds are acquiring the fœtal character: between the fourth and fifth intercostal spaces scarcely any thing is heard but the second sound; pulse 92.	Continue wine and mixture; cupping, and blister to the chest.
" 12.	The bronchitis more severe, but the countenance has a better expression.	The first sound is more distinct; at the mamma both sounds can be heard, although feebly; pulse 84.	Wine 12 oz., Decoct. Senegæ, et Carb. Ammon.; dry cupping between the shoulders.
" 13.	Bronchitis continues.	Both sounds are now distinctly audible under the mamma and below the sternum.	Wine 8 oz.; rept. alia.
" 14.	Slept well; some aphonia, with tenderness of the trachea on pressure; countenance flushed.	The impulse of heart just perceptible; sounds distinct, still feeble; pulse 92.	Wine 8 oz.; Blister to throat.
" 15.	Bronchitis less: passed a good night.	Both sounds of the heart are proportionate; pulse 82.	Wine 6 oz.
" 16.	Bronchitis subsiding in the right lung, but engaging the minute tubes of the left to a considerable extent.	Both sounds proportionate and distinct; pulse 88.	Wine 6 oz.
" 21.		Impulse of the heart perceptible; the sounds natural; pulse 60.	Dry cupping senega mixture, with antimony.
" 24.	On this day he was pronounced convalescent.		

CASE X.

Petechial fever—Diminution and temporary alteration of the first sound of the heart—Recovery.

Thomas Devereux admitted into hospital on the 23rd of May; the eighth day of fever. Petechiæ plentiful, but of healthy colour; respirations hurried; complains of cough, which is accompanied with a frothy mucous expectoration; bronchitic rales are only heard in the upper portion of the right lung,—is very low; pressure on the abdomen gives pain; great thirst: the impulse of the heart is scarcely perceptible; the sounds are proportionate, but feeble; pulse 112. Ordered six leeches to the epigastrium; castor oil 3 oz., in emulsion, with tinct. opii ♏iii.

DATE.	GENERAL SYMPTOMS.	PHENOMENA OF CIRCULATION.	TREATMENT.
May 24.	Complained of intense headach yesterday evening, which was relieved by epistaxis; bronchitic rales very intense; breathing laboured; respirations 40.	Sounds of the heart are feebler than yesterday; pulse 116, fuller and stronger.	Wine 6 oz.; cupping to 8 oz.; emp. lyttæ over the heart.
" 25.	Bronchitic rales not so intense; respirations 48; countenance more animated; abdominal tenderness completely gone; had slight epistaxis yesterday evening; some headach.	Pulse 108; sounds of the heart *somewhat louder over the apex;* impulse perceptible.	Omit wine; leeches to the temples.
" 26.	Three leeches were applied, and gave great relief; respirations 48; slept well.	The pulse taken early in the morning was 108; later in the day 116; the sounds of the left cavities of the heart are exceedingly feeble, *at the apex the first sound can be distinguished, but at the mamma only the second is heard;* the superiority of the second over the first is also perceived over the right cavities; impulse just perceptible.	Mist. cerverus.
" 27.	Slept well; bronchitis better; complains of stuffing in his head; countenance to-day is more flushed; had slight epistaxis yesterday evening; respirations 44.	Pulse 100, soft and compressible; impulse of the heart perceptible; the sounds are feeble, the second still predominates over the first.	Omit mixture; potter-a pint; arrow root diet.
" 28.	Had slight epistaxis yesterday evening; slept well.	The sounds of heart are yet feeble, the second predominating over the first; pulse 96, good strength.	Senega mix-

DATE.	GENERAL SYMPTOMS.	PHENOMENA OF CIRCULATION.	TREATMENT.
May 29.	Respirations 28, easy; no headach; slept well.	Sounds to the left of mamma very weak, *distinct however; much stronger to the right.*	Continue.
" 30.	Respirations 28; tongue clean and moist; skin cool; slept well; countenance improved; still has slight bronchitis.	Pulse 76, soft; phenomena of the heart as before.	Continue; porter one pt.
" 31.	Much improved.	Impulse of heart perceptible; the sounds over the left cavities are stronger, the two sounds being now proportionate.	Porter one pt.
June 1.		Pulse 60, natural; the sounds of the heart are stronger; impulse perceptible.	Porter and beef tea.
" 8.	Convalescent.		

CASE XI.

Petechial fever—Supervention of signs of bronchitis on the twelfth day—Slight change in the phenomena of the heart—Moderate use of wine—Recovery.

Rose Devereux, admitted on the 23rd June; eight days ill; at present complains of great pain and soreness in all her limbs; headach; pressure on the abdomen gives pain, especially in the epigastrium and hepatic region; no bronchitis; both sounds of the heart are natural; impulse perceptible; pulse 100, feeble; on being made to sit up in bed, she is obliged to cling for support to the bed-side, in consequence of a feeling of lightness in her head, and dimness of sight; respiration easy; tongue clean; no petechiæ.

Hirudines x. Epigastrio. Haustus Efferves.

DATE.	GENERAL SYMPTOMS.	PHENOMENA OF CIRCULATION.	TREATMENT
June 25.	Intense headach; great thirst; nausea and retching whenever she attempts to sit up; no abdominal tenderness; bowels costive; respirations 40.	Pulse 112, compressible; both sounds of the heart are proportionate; impulse perceptible.	Tart. potass. et sodæ, ½ oz. enema purgans.
" 26.	Slept well; no headach; slight epistaxis yesterday evening; bowels free; *no bronchitis or cough.*	Pulse 116; impulse perceptible; both sounds of the heart are natural and proportionate.	Milk whey.
" 29.	Yesterday evening complained of great oppression in her breathing; on percussion the chest was clear, *but a most intense bronchitis engaged the whole of left lung;* did not sleep last night;	The sounds of the heart are much obscured this morning in consequence of the intensity of bronchitis; they are, however, sufficiently clear to enable us to determine that they are propor-	Cupped freely yesterday evening. Pil. hydrarg. gr. iii., pulv. ipecac. comp. gr. ii., ft., pil.

	GENERAL SYMPTOMS.	PHENOMENA OF CIRCULATION.	TREATMENT.
	countenance anxious; constant nausea; some cough; sputa viscid; bowels free; respirations 36.	tionate; impulse perceptible; pulse 124.	quater in die sumend.
June 30.	Passed a tolerable night; cough not very troublesome; tongue slightly furred; skin cooler; bronchitis in both lungs; respirations 40; bowels regular; had some vomiting yesterday evening, of a greenish fluid; nausea continues.	Pulse 124; impulse of the heart quite imperceptible; sounds hurried, feeble, but proportionate.	Repeat pill.
July 1.	Vomiting last night; the fluid thrown off the stomach is of a dirty green colour, the consistence of treacle; no headach; complains of great oppression in her chest; bronchitic rales are not so intense; petechiæ abundant.	Pulse 120; impulse imperceptible; sounds very feeble, but proportionate.	Wine 6 oz.; repeat pill.
" 2.	Bronchitis much better; she breathes very easily; vomiting this morning; skin cool; petechiæ paler than yesterday.	Pulse 96, feeble; no impulse to be felt; sounds stronger than yesterday.	Wine 6 oz.; omit pills.
" 3.	Very much improved; slept well last night; complains of thirst; no headach; respirations natural.	Pulse 76.	Wine as before.
" 4.	Countenance much improved; no headach; scarcely any bronchitis; respirations natural.	Pulse 76; sounds proportionate, but the impulse cannot yet be felt.	Continue treatment.
" 5.	As yesterday.	Pulse 60, tolerable strength; impulse of the heart is just perceptible.	Repeat all.
" 6.	Sat up in bed the greater part of yesterday without any inconvenience; appetite very good.	Pulse 60, impulse of the heart is perceptible; sounds proportionate.	Repeat.
" 7.	Convalescent. In a few days was discharged cured.	Pulse 60; of good strength.	Continue wine 6 oz.

In the three preceding cases a general similarity may be observed: in all there was the petechial eruption, and the signs of bronchitis existed at some period of the cases respectively. In the two first, those of Wallace and Thomas Devereux, we had the peculiar phenomena of the heart well marked; while in the third—they were so slightly manifested, that it is difficult to say whether the patient

really had any positive affection of the heart. It is remarkable, accordingly, that the necessity for the use of wine was by no means so great in her case. Indeed the quantity of wine employed in the female wards is greatly less than in the male; the phenomena of putrescence being much more often manifested in the male subject.

In the case of her brother Thomas Devereux, the diminution of the first sound was most remarkable. The case illustrates some curious points.

In the first place it shows how little we can judge of the actual condition of the heart by the examination of the pulse. On the ninth day the pulse had increased in frequency, volume, and strength; and yet the sounds were more feeble than on the day before. I have shown that we may have a vigorous heart with a feeble pulse, or even absence of pulse, and here we have the converse of the proposition. The sounds of the heart became more feeble while the pulse was stronger. Indeed we could never determine from the pulse whether or not the phenomena of the heart were altered, and the fact is, that it is by the physical signs, and the application of the hand alone, that we can ascertain how far the heart is affected in typhous fever. In this case, however, the fulness and increased strength of the pulse preceded a certain degree of reaction; for on the next day the sounds were louder, the countenance more animated, and there was headach: we then omitted the wine. The excitement, however, was but temporary, for in twenty-four hours *the first sound was completely lost at the mamma.*

We sometimes meet with cases in which stimulation is necessary, yet the patients do not bear wine well. In such cases I exhibit porter, which answers well.

CASE XII.

Petechial typhus, with diarrhœa and bronchitis—Cessation of the first sound of the heart—Exhibition of wine delayed till the twelfth day—Return of the first sound on the fourteenth—Recovery.

John M'Kone was admitted on the 1st May, on the eighth day of his fever; there is no petechial eruption; complains of troublesome cough; bronchial rales in both lungs; tongue covered with a brown crust; the impulse of the heart *is perceptible; the first sound* is almost inaudible, the second is perfectly distinct; pulse small, 120.

Pil. hydrarg. gr. iii. Pulv. Doveri, gr. ii. ter die sumend.

DATE.	GENERAL SYMPTOMS.	PHENOMENA OF CIRCULATION.	TREATMENT.
May 2.	Raved during the night; got some sleep towards morning; seems much depressed.	Pulse 120, small and quick; impulse of heart is still perceptible; the second sound predominates considerably over the first.	Repeat medicine.
" 3.	Passed a much quieter night than the last; raved	Pulse 120, and fuller; impulse scarcely perceptible.	Ext. hyoscyam. gr. iii.,

DATE.	GENERAL SYMPTOMS.	PHENOMENA OF CIRCULATION.	TREATMENT.
	a good deal towards morning; tongue very much furred; great thirst; bronchitis continues; maculæ are now very plentiful; headach.		pulv. ipecac. gr. ss., tertiis horis sumend.
May 4.	Raved much less last night; no headach; eyes suffused; countenance rather flushed.	Pulse 120; the first sound of the heart is almost lost; the second is distinct.	Beef tea.
" 5.	The petechiæ are not more livid, nor are they paler; some purging yesterday and to-day.	Pulse 124, easily compressed; *the double character of the sounds of the heart is now completely lost; the second alone being audible;* the impulse is not to be felt.	Wine 10 oz. chalk and opium mixture.
" 6.	Has passed a great many bloody stools; much delirium; his countenance, however, is not expressive of great depression; rest broken by being obliged to leave his bed; petechiæ have faded considerably.	Pulse 112; the sounds and impulse as yesterday.	Wine 10 oz.; repeat mixture; beef-tea.
" 7.	Was exceedingly delirious the whole night, so much so as to render the strait-waistcoat necessary; has passed three motions not bloody; subsultus tendinum.	Pulse 92; the impulse is yet imperceptible; the *first sound is again audible to day;* the second distinct and clear.	Wine 10 oz.; draught of muriate of morphia; beef tea.
" 8.	Did not rave at all; slept almost the whole night; countenance much more animated; speaks quite rationally; bowels moved twice, fæces assuming their natural form; tongue cleaning and moist; but little thirst; *he did not get the morphia;* petechiæ quite gone.	Pulse 80, of good strength; the impulse is perceptible; the first sound stronger to-day, giving less predominance to the second.	Wine 5 oz.; arrow root diet.
" 9.	Slept very well; did not rave; says he could eat a bit of bread if he had it; bowels much improved; two motions yesterday; is much better.	Pulse 80, and of good strength; impulse perceptible; there is very little difference between the sounds of the heart.	Continue wine 5 oz.
" 13.	Convalescent.	Pulse 76, natural.	Has had wine 5 oz., and beef tea daily since last report.

This case is principally interesting from the complete disappearance of the first sound of the heart for at least forty-eight hours; the coming down of the pulse under wine preceded the return of the first sound and the impulse: throughout the whole of this case the second sound continued remarkably clear.

The exhibition of wine was delayed too long in this case; we

were misled by the absence of petechiæ on the eighth day; they did not appear till the tenth day, an unusually late period.

The next case is remarkable for its presenting the peculiar cardiac phenomena in fever, with a singular slowness of the pulse during the disease, and also in the convalescence.

CASE XIII.

Maculated fever, with bronchitis—Feebleness of the first sound—Slowness of pulse—Free use of wine—Recovery.

Richard Edwards, æt. 26; admitted into hospital on 8th June, ten days ill; the petechiæ are very plentiful and of healthy colour; countenance much depressed; tongue very thickly coated; great thirst; did not sleep well last night, but was continually raving; complains of irritation in his throat, which is not inflamed; great oppression in his breathing; acute bronchitis in left lung; cough troublesome; expectoration viscid; abdomen full and tympanitic, but without pain on pressure; impulse of the heart is perceptible: the sounds are very weak, and the second predominates over the first; pulse 84, feeble; bowels free; respirations 48. To be cupped freely between the shoulders; blister to the sternum; senega mixture, wine viii. oz.

DATE.	GENERAL SYMPTOMS.	PHENOMENA OF CIRCULATION.	TREATMENT.
June 10.	Raved a good deal last night; countenance anxious; conjunctivæ infected; tongue much coated; no headach; cough not very troublesome; expectoration viscid and scanty; respirations 48; bronchitis in both lungs; more severe in the left; bowels rather too free; evacuations thin and watery; extremities warm.	Pulse 80, small and compressible; the first sound of the heart is so feeble as to be almost inaudible; the second is very clear; impulse just perceptible.	Wine 24 oz.; repeat mixture; blister over the heart in the evening, if necessary.
" 11.	Passed a good night; the blister was applied yesterday evening; is very weak this morning; countenance expressive of great anxiety; tongue coated; breathes easier; coughs less; expectoration profuse and thick; respirations 40; is not purged, but passed two thin watery stools.	Pulse 80, feeble; we could not examine the state of the heart in consequence of the blistered surface being very painful.	Wine 24 oz.; repeat mixture.
" 12.	Countenance much improved this morning; breathes easily; bronchitis better; did not rave; bowels moved three times; character of	Pulse 80, feeble; the impulse of the heart is perceptible; the second sound is still loudest.	Wine 16 oz.; repeat mixture.

DATE.	GENERAL SYMPTOMS.	PHENOMENA OF CIRCULATION.	TREATMENT.
	stools somewhat better; respirations 36; expectoration not so profuse; coughs much less.		
June 13.	Countenance considerably improved, and he is much better this morning in every respect; sputa profuse again to-day; does not complain of much thirst; respirations 26.	Pulse 80, and fuller; impulse and sounds as last report.	Wine 12 oz.
" 14.	Slept very well; petechiæ fading; tongue cleaning and moist; bronchitis much better.	Pulse 68, and of good strength; impulse of heart perceptible; sounds improving; the second yet predominates.	Wine 12 oz.
" 15.	Countenance more animated; voice stronger; very little expectoration; bronchitic rales are still loud; bowels regular: no petechiæ.	Pulse 60, soft and compressible; the first sound of the heart much improved in strength, giving little predominance to the second.	Wine 12 oz.; bark mixture.
" 16.	Bronchitis rapidly improving; respirations natural; converses rationally.	Pulse 60; impulse of heart very feeble; the 2nd sound still predominates.	Wine 6 oz.
" 17.	Expectoration is scanty, and tinged slightly with blood; on carefully examining the chest, no signs of pneumonia can be discovered; and the bronchitis is much less intense.	Pulse 54, stronger; impulse and sounds as last report.	Wine 6 oz.
" 18.	Sputa free from admixture with blood; is considerably better; appetite good.	Pulse 56, regular; impulse perceptible; and the sounds of the heart are once more proportionate.	Wine 6 oz.
" 19.	Passed a very good night; tongue clean; no cough; bowels regular; skin cool.	Pulse 52; strong; phenomena of heart natural.	Wine 6 oz.
" 20.	As last report.	Pulse 46, and strong.	Wine 6 oz.
" 21.	Quite convalescent.	Pulse 44, and of exceedingly good strength.	Wine 6 oz.
" 22.	He was out of bed for the greater part of yesterday, and bore the exertion well.	Pulse 44; on walking across the ward and back again, the pulse rose to 60.	Mutton chop.

We have now recorded two cases, in which the phenomena in question coincided with a very slow action of the heart, and in which the pulse during convalescence became singularly diminished

in frequency. To this I would particularly direct the attention of my readers, as it bears on a very important practical point, namely, the cause of the anormal conditions of the pulse in the convalescence of fevers.

In my remarks on the fourth case, (see page 13,) I have alluded to the opinion of Laennec, who, after describing the softened state of the heart in putrid fevers, inquires whether this condition could account for the frequency of pulse which exists, sometimes for several weeks, in convalescence from fevers, although the patient continues to regain flesh and vigour.[1]

If the phenomena now described are connected with a softened state of the heart, it will appear that our experience in this matter is opposed to the idea above quoted. It will be observed that in most of the cases the pulse came down to its ordinary rate, and did not exhibit any unusual frequency during convalescence; and that in several, and in two particularly, the pulse in convalescence fell far below its usual standard. And with respect to the frequency of pulse in convalescence, alluded to by Laennec, my experience at present is, that it is more likely to occur after fevers of a *non-putrid* character; and that it often points out the existence of some local irritation, or a tendency to it. Future observations must settle this point.

I might add several other cases presenting analogous phenomena, but refrain from doing so, as they do not exhibit any features different from those already described.

It will be seen that, in all the preceding cases, the modifications of the heart's action was either the diminution or obliteration of the first sound, or the equable diminution of both, so as to produce the fœtal character: but there is another modification, which, though of rare occurrence, is most interesting: in this we find the *first sound preponderates.* Of this variety but two cases have been observed: the first occurred in my own practice, and the second was of a patient treated by Dr. Graves, for the history of which I am indebted to one of our most accurate observers, Mr. William M. Murphy.

CASE XIV.

Petechial fever, with bronchitis and diarrhœa—Vigorous action of the heart up to the ninth day—Preponderance of the first sound on the sixteenth day—Use of wine—Recovery.

Thomas Keefe, æt. 30, a strong muscular man, was admitted on the 11th May, being then nine days ill; he was abundantly maculated; well marked bronchitic rales in both lungs; the action of the heart was vigorous, and both the sounds natural; pulse 108, full. The chest was cupped and blistered, and pills of blue pill and ipecacuanha exhibited.

[1] Laennec, Art. Softening of the Heart.—See Dr. Forbes' Translation.

DATE.	GENERAL SYMPTOMS.	PHENOMENA OF CIRCULATION.	TREATMENT.
May 13.	Severe diarrhœa.	Pulse strong; both sounds are distinct and proportionate, but they seem as if distant.	Omit the pills; poultices to the abdomen.
" 14.	The diarrhœa continues; maculæ abundant and florid.	Sounds of the heart more feeble; the impulse is imperceptible except at the termination of expiration; pulse 100, strong.	Saline mixture; arrow root.
" 15.	The bronchitis is more severe.	Impulse quite imperceptible; both sounds feeble but distinct; pulse 100, feeble.	Wine 6 oz.; dry cupping; blister to the chest; pills of ipecacuan. hyosciamus, and carb. ammonia.
" 16.	Pupils contracted; bronchitis continues; tongue glazed and red.	Impulse imperceptible; sounds as before; pulse 92, a shade stronger than yesterday.	Wine 12 oz.; beef tea; antimonial mixture, with 3 grains of tart. emet.
"	Some diarrhœa; no vomiting; bronchitis diminished; the petechiæ are not more livid; pupils less contracted; tongue improving, becoming moist and pale at the edges; the wine was given warm.	Impulse again perceptible; pulse 82; both sounds of the heart can be heard.	Wine 10 oz.; senega mixture; musk and camphor pills.
" 18.	Tongue improving; petechiæ fading.	Sounds of the heart not so distinct as yesterday; *the second can scarcely be heard;* impulse perceptible.	Repeat all.
" 19.	Slept well; diarrhœa continues.	Sounds as yesterday; impulse imperceptible.	Wine 10 oz.; blister to the heart; bark mixture.
" 21.	General improvement; slept well; perspiration.	*Both sounds can now be heard; they are feeble but proportionate;* impulse imperceptible; pulse 72.	Wine 8 oz.; repeat the mixture.
" 22.	Improvement continues.	The sounds over the right cavities are proportionate; *over the left the first is much more feeble than the second;* no impulse.	Repeat all.
" 23.	Skin cool; appetite good; no bronchial râles.	First sound much more distinct; impulse plainly perceptible; pulse 72.	Wine 4 oz.
	Convalescent.		

CASE XV.

Petechial typhus with palpitation of the heart and bronchitis—Preponderance of the first sound of the heart—Recovery.

William Hawkins, æt. 34, tall, not very robust; admitted into hospital October 18th, 1838; eleven days ill. Illness commenced after exposure to a draught of air, by rigors, succeeded by heat, &c., also by violent palpitations of the heart, which he says lasted for seven days. On admission the pulse was intermitting; there was a strong action of the heart, but it was also intermitting.

19th, (twelfth day). Abundantly maculated, severe headach, impulse of the heart feeble, no intermission of sounds. *First preponderates considerably, most marked at the sternum;* abdomen tympanitic; he is constipated; a blister was applied to the abdomen; camphor mixture, chalk mixture, and rhubarb wine ordered, and a turpentine enema; the pulse was regular 100.

20th, (thirteenth day). The pulse was 104, stronger but intermitting; no impulse; the sounds more feeble, and intermitting synchronously with the pulse, *first preponderating considerably;* bronchitis in both lungs; was cupped, blistered, and ordered 5 grs. of hydrarg. c. cret. every fourth hour. Was visited in the evening, and the pulse and heart were regular. The bronchitis became very severe, for which he was repeatedly blistered, and the mercury pushed to slight salivation; the pulse and heart continued without intermission, *but the first sound preponderated all through.*

On the 24th, (seventeenth day of illness), he got 6 oz. of wine. On the 28th, (twenty-first day), the pulse was 64; no impulse of heart, the sounds became proportionate. On November 4, (twenty-ninth day), the impulse was felt, sounds proportionate, pulse 64.

November 12th. Left the hospital quite well.

We have thus two cases in which the first sound preponderated. In the first this peculiarity was not observed until the sixteenth day; while in the second it was recognized on admission, (the ninth day,) and the sounds did not become natural until after the twenty-first. In this case it will be observed, that the pulse was intermitting, and that the patient complained of palpitation from an early period of the fever.

Let us now examine the results of dissection in a few cases in which feebleness of the heart's action was recognized.

CASE XVI.

Severe maculated typhus complicated with intense bronchitis—Gastritis—Perspiration on the 13th—Employment of wine—Death.

John Harris, of full plethoric habit, had always enjoyed good health, and although in the habit of taking whiskey, never drank to excess; has had fever for six days; his chest and arms are covered with well defined bright red petechiæ, complains of much

pain in the head and dimness of sight; tongue furred, epigastrium very tender on pressure, bowels constipated; passes small quantity of urine; pulse 96, and full; respirations 28; some wheezing and sibilant ronchi are heard in anterior portion of lungs, face very much flushed. He was ordered efferv. draughts.

DATE.	GENERAL SYMPTOMS.	PHENOMENA OF CIRCULATION.	TREATMENT.
June 8.	Presents the same appearance as yesterday; slept badly; bowels relieved.	Pulse 96.	Wine 6 oz.
" 9.	Has had another bad night; is very restless; countenance flushed.	Sounds of the heart very feeble; pulse small and compressible, 96.	Continue wine.
" 10.	Better night than he has yet had.	Pulse much stronger and fuller, 104, and by no means so compressible; sounds of heart a shade stronger than yesterday.	Continue wine.
" 12.	Did not sleep so well as on the previous night; extreme debility.	Pulse 116; sounds of the heart precisely resemble those of the fœtus in utero.	To have a glass of hot punch immediately; wine 12 oz.; blister between the shoulders and terebinthinate enema.

From this period the patient got worse. The bronchial disease became intense and general, so much so that it was hardly possible to make any accurate observation of the sounds of the heart; the impulse, however, was imperceptible; the pulse became intermitting, and increased in frequency to 120, and on the next day to 136. He died on the following day, the seventeenth of his disease. On the sixteenth day his extremities were cold. In this case active stimulation was employed. The patient got nearly eighty ounces of wine; he was dry-cupped and blistered, and used emetics, from which he experienced great relief three days before his death.

Post Mortem, eleven Hours after Death.—The heart is of its natural size, livid, and feels extremely soft, pitting on pressure, particularly over the left ventricle; some white patches may be seen on the right ventricle; the lining membrane of the left auricle presents nothing remarkable; the left ventricle was divided from its base to apex; the muscular substance presents a very singular appearance, not a trace of fibre being visible; and for more than two-thirds of its length, a layer presenting a darker colour and of more homogeneous appearance, of one-eighth of an inch in thickness, was found; into this layer it is very difficult to trace the muscular fibre. The substance of the ventricle is infiltrated with a gummy matter, causing the fingers to stick together; the structure has some resemblance to the cortical structure of the kidneys; a transverse section

gave the same appearance. The net-work of fleshy fibres exhibits more firmness, though analogous in condition; the posterior columns seem but little altered, being only pale, their firmness remaining perfect; the same may be said with respect to the anterior; the right ventricle is harder and firmer, and does not exhibit the same aspect as the left; the auricle of the same side contains a coagulum; nothing remarkable in the colour and appearance of the membrane; the septum cordis presents the same appearance as the left side. On examining the abdomen, nothing abnormal presented itself. The ileum is perfectly healthy; no enlargement of the glands.

CASE XVII.

Maculated typhus with severe nervous symptoms—Predominance of the second sound on the sixth day; complete absence of the first sound on the tenth day—Death—Softened state of heart—Ulceration of the ileum.

Richard Cashel, æt. 46, admitted 5th November; six days ill; he complains of pain in back, neck, and extremities; considerable prostration; maculæ abundant, of light colour on chest and abdomen, but much darker on back; slept very little last night; raved a good deal, but was not violent; has no headach; pupils slightly contracted; very little cough unaccompanied by expectoration; stools thin and watery; abdomen soft and tender on pressure; great thirst; tongue brown and dry in centre; teeth covered with sordes; pulse 116, rather feeble; respirations 28; auscultation detects slight bronchitis in both lungs; while the patient lies on his back the impulse of the heart cannot be felt, but becomes imperceptible when he turns on his left side; both sounds are audible, and the second predominates slightly over the first; ordered an anodyne enema.

DATE.	GENERAL SYMPTOMS.	PHENOMENA OF CIRCULATION.	TREATMENT.
Nov. 7.	Raved much; skin hot and dry; maculæ dark; respirations 28.	Pulse 116, as yesterday; the impulse of the heart cannot be felt to-day; sounds more feeble than yesterday, scarcely audible above the mamma, and to the left: more so at the sternum; the second preponderates.	Repeat wine, 8 oz.
" 8.	No raving; extreme prostration; considerable fœtor from body; maculæ very dark coloured; sordes on teeth and tongue excessive; is unable to raise himself without assistance.	Pulse exceedingly feeble and irregular, being from about 116 to 124; no impulse of heart; sounds very feeble, almost inaudible to the right of nipple; the *second* is still loudest.	Wine 16 oz.; beef tea.
" 9.	Was very restless all night; picking at the bed-clothes, and muttering constantly; passes his water under him; lies on his	Pulse 120, exceedingly feeble, obliterated on the slightest pressure; when lying on his left side the impulse could then be felt,	Wine 20 oz.; brandy 2 oz.

DATE.	GENERAL SYMPTOMS.	PHENOMENA OF CIRCULATION.	TREATMENT.
	side; maculæ very abundant, and quite livid on the back.	but on turning on his back it was felt to be vigorous; *the double sound of the heart was completely lost, the distinct clear "rap" of the second alone being heard; most distinct also at the base of heart.*	
" 10.	Lies on his back; mouth wide open; constant spasm of the muscles of lower jaw; constant moaning; *is in profuse perspiration;* excessive fœtor from body; respiration 40; stools involuntary.	Pulse 150, exceedingly weak and irregular; impulse of heart evident and pretty strong; in consequence of his moaning, no accurate accounts of the sounds could be taken.	

Died at 1 o'clock, P. M.

Dissection twenty Hours after Death.—The body was more than usually livid; the petechiæ were pale on the forepart of the body, but very dark and livid on the back; abdomen tympanitic; the pericardium contained about half a pint of straw-coloured serum; the heart was of large size, and so extremely flabby, that it was capable of retaining any shape in which we placed it; the *right cavities* were softer than natural, admitting the fingers through their walls without much resistance; in the muscular structure of the left cavities, however, this change was much more remarkable; the weight of the finger was almost sufficient to penetrate its walls, they were so exceedingly softened; it is very easily torn, and the edges thus separated have no longer the moistened appearance, but seem as if quite dry. The septum cordis was equally softened; there was some dark fluid blood in the right cavities. The stomach presented some red patches, slightly elevated; towards the pylorus, the mucous membrane was thickened and softened, and was easily removed by the handle of the scalpel. The duodenum was tolerably healthy, having only in two or three places slight blushes of inflammation. The ileum was more extensively involved; this was particularly observable in the last two feet of its length, near to the ileo-cæcal valve: there were five ulcerated points; the superficies of the ulcers were covered by a delicate membrane, beneath which there was a yellow-coloured fluid, resembling pus; the largest was about the size of a silver penny: round these infiltrated points the intestine was much inflamed, and several minutely injected capillaries were seen ramifying around these points, but they could not, even by the aid of a good lens, be traced into the ulcers; when the membrane was removed under water, and the puriform matter washed off, a decided depression was left, at the bottom of which was easily seen the muscular coat of the intestine: dispersed further throughout the intestine were several of the elliptical patches. The glandulæ aggregatæ were very prominent in many places.

The general type of fever in this case did not at first seem worse than in many others in which recovery took place. But the patient had been greatly exhausted before admission by hypercatharsis, induced by two enormous doses of castor oil which he took on the second and fourth days of his disease. This circumstance is not unfrequently met with in our wards; and I do not know a worse preparation for the struggle in the advanced stage of typhus than over purging in the commencement. The medicine commonly employed is glauber salts, in a very large dose; this is taken independent of any medical advice, and in several cases the ulceration of the intestines seems to have been promoted by its action.

The pulse in Cashel's case rose from 116 to 150, *under the use of wine.* This and the extreme fœtor of the body led to the worst prognosis.

In the phenomena of circulation, the most interesting point is, that while the first sound was absent, *the impulse continued. On the day of his death the impulse was very evident, and yet we found a softened left ventricle.* We shall see that the diminution or cessation of the first sound, and of the impulse, are not always co-existent. It is hardly necessary to observe on the difference between these phenomena and those in the case in which wine was successfully employed. On two occasions we were forced to omit the wine, and ultimately we abandoned its use.

In this case, also, the peculiar diminution of the first sound was not observed until the day before death; and on the previous day, (two days before death,) the impulse and sounds were strong. I conceive that the morbid change in the left ventricle did not occur in this patient so early, or to the same extent, as in other cases.

In observing on the cases of Cavanagh and Smyth, (see page 19,) I have stated that we have not yet recorded any instance in which the alteration of the first sound was accompanied with or preceded by signs of irritation. In this case, however, and in that communicated by Mr. Murphy, *where the first sound predominated,* the symptom of irregularity of the heart existed; and in Mr. Murphy's case there was pain. How far these circumstances indicated inflammation we cannot now determine; but it must be remarked, that the effect of wine was totally different in the two cases.

CASE XVIII.

Severe maculated typhus, with cerebral irritation, and great prostration—Diminution of the first sound of the heart on the day before death—Use of wine—Death on the nineteenth day.

Catherine Murphy, æt. 30, of good constitution; six days ill on the 10th of June. She complains of pain of the forehead and temples, for which she was leeched, without relief. The petechiæ are abundant, and very livid; no thoracic complaint; has much abdominal tenderness, and diarrhœa. Was ordered six leeches behind the ears.

DATE.	GENERAL SYMPTOMS.	PHENOMENA OF CIRCULATION.	TREATMENT.
June 11.	Tongue furred, and dry; purging still continues; respirations 44.	Pulse 120, feeble; impulse of the heart perceptible; both sounds of the heart proportionate.	Wine 4 oz. arrow root.
" 12.	Had a restless night; passes her urine involuntarily, and is much weaker than yesterday; pain of forehead and temples continues; respirations 32.	Pulse 120; sounds of the heart louder than yesterday.	Wine 12 oz.
" 13.	Raved a good deal last night; *after having taken eight ounces of wine, pulse rose to* 130, *and was very small;* has no purging; tongue coated, and dry.	Pulse 130, very feeble; sounds of the heart proportionate, but feebler than yesterday; impulse scarcely perceptible.	Blister applied over the sternum; continue wine as yesterday.
" 14.	The blister was applied yesterday, but in consequence of her changing the position so very frequently, it did not rise; the acetate of cantharides was then used and proved efficacious; very low; respirations 32.	Pulse so irregular that it cannot be counted; impulse not perceptible; sounds of heart as yesterday.	Wine 24 oz.
" 15.	Raved all night; does not pass her water under her, but gets up whenever it is necessary.	Pulse 124, and full; impulse and sounds of the heart as yesterday.	Continue treatment.
" 16.	Did not rave last night; the wine produced so much excitement yesterday afternoon, that it was found necessary to stop its further exhibition.	Pulse 112.	Wine 12 oz.
" 17.	Was again obliged to stop the wine; after taking eight ounces; bowels regular; tongue cleaning.	Pulse 100; impulse of the heart again perceptible, and the sounds proportionate and stronger.	Omit wine; beef tea.
" 18.	Raving and moaning throughout the night; respirations easy and natural.	Pulse 104; impulse and sounds of the heart as yesterday.	Anodyne draught.
" 19.	Raving all night; on pressing the larynx, she complains of pain, but will not allow an examination.	Pulse 120, and full.	Anodyne enema; flannel waistcoat.
" 20.	Did not rave last night; sacrum very sore; pupils contracted; allowed her throat to be examined this morning, when several diphtheritic patches were seen.	Pulse 130, and very feeble.	The strong muriatic acid to be applied to the throat; blister to neck.
" 22.	Extreme prostration, but	Pulse 120; heart's ac-	Decoct. cin-

DATE.	GENERAL SYMPTOMS.	PHENOMENA OF CIRCULATION.	TREATMENT.
	is perfectly sensible; voice much clearer than yesterday; respirations 40.	tion morbidly excited; sounds proportionate.	chon. 6 oz.; tinct. cinchon. 3 oz.; sumat ℥ i. secundis horis; porter one pint, and beef tea.
June 23.	Is still sensible; countenance expressive of great anxiety; is very low; moaning, and tossing her arms about considerably; respirations hurried, 64; teeth thickly covered with brown sordes.	The first sound of the heart is scarcely audible, while the second is distinct and clear; pulse extremely feeble, and so irregular that it cannot be counted.	As yesterday.
" 24.	Died at half past one.		

Dissection twenty hours after death.—The body presented an unusually livid appearance. On the abdomen were observed numberless minute vesicles, and on the sacrum there was a large sloughing sore. The muscular structure was firm and healthy. On opening the chest the lungs presented a healthy appearance; posteriorly they were rather congested, but this seemed to be the result of gravitation of blood. The pleuræ were not adherent. On slitting up the pericardium it was found to contain about half a pint of straw coloured fluid; the covering itself seemed healthy. The heart was of small size; the muscular structure of the left ventricle was softened, but not to the same extent as in the preceding cases; on cutting into it, the fibres were perceptible, but they presented, nevertheless, a rather homogeneous appearance, and a peculiar glairy semi-gelatinous fluid was found between them; there was no valvular disease. The intestines were bound down by old adhesions, and were free from ulceration; the smaller were much congested and softened.

The circumstances worthy of remark in this case, are, that wine did not agree with the patient, and that the phenomena of the heart were very different from those detailed in most of the preceding cases. Under the use of wine the pulse rose from 120 to 130, and then became exceedingly irregular; it next fell to 124, and was full; it continued to diminish in frequency; again increased, and became irregular. Its rate was as follows:

Seventh day, 120.
Eighth day, 120.
Ninth day, 130.
Tenth day, irregularity so great that it could not be counted.
Eleventh day, 124.
Twelfth day, 112.
Thirteenth day, 100.
Fourteenth day, 104.
Fifteenth day, 120.

Sixteenth day, 130.
Seventeenth day, 120.
Eighteenth day, irregularity as before.

CASE XIX.

Petechial typhus, with severe nervous and catarrhal symptoms—Great feebleness of the heart on the twelfth day—Use of wine—Vigorous action of the heart for four days before death.

Eliza Bourke, æt. 35. admitted on the 7th March, the eleventh day of fever. On admission she was delirious; in a state of great collapse, with cold extremities, and miserable pulse. She was given 4 oz. of wine, and artificial heat applied to the feet; during the night she never ceased howling and screaming; lies on the back in an extreme state of prostration, raving immoderately, moaning, and sometimes screaming aloud. Countenance flushed, wild, and ferocious; eyes suffused; pupils natural; sordes on teeth and lips; she points to the head as the seat of much distress; thirst urgent; skin hot, dry, and covered with livid coloured petechiæ, evidently on the decline; tongue fissured and brown; pulse 136, small and weak; respirations 40, laboured and interrupted; intense general bronchitis; impulse of the heart imperceptible; no accurate observations could be made as to the sounds, from the loudness of the râles.

DATE.	GENERAL SYMPTOMS.	PHENOMENA OF CIRCULATION.	TREATMENT.
March 9.	Thirteenth day of fever; slept well; delirium much less; pupils somewhat contracted; upper and lower extremities quite cold; tongue covered with black crust; respirations 28.	Pulse 140, small and weak but a degree stronger than yesterday; impulse of heart slightly perceptible; both sounds can now be heard below the mamma, and are much stronger than yesterday.	Wine 24 oz.; turpentine enema.
" 10.	She is more tranquil, but the countenance retains the wild expression; extremities warm; respirations 32, laboured.	Pulse 128, much fuller and stronger; the impulse is much improved, and the heart can be felt pulsating over several square inches; the sounds are louder, and the first sound has increased in strength.	Repeat wine; blister to the head.
" 11.	After each dose of wine, which has been given mulled, her general appearance became much improved, but the bronchitis is very intense; and in both lungs, inferiorly, a moist crepitating râle can be heard.	*No change* in impulse and sounds of heart; pulse 132.	Repeat wine.
" 12.	Breathing more difficult and laboured; great wheez-	The impulse of heart still more perceptible, but its	Repeat wine; pills of ipecac-

DATE.	GENERAL SYMPTOMS.	PHENOMENA OF CIRCULATION.	TREATMENT.
	ing in the throat; respirations 44; and râles in all parts of the chest more sonorous and intense.	sounds much obscured by the râles.	carb. ammon., & hyoscyam.
March 13.	She is sinking rapidly; respirations 64 in a minute; congestion of the lung much increased.	Pulse 124; no change of the impulse or sounds of the heart.	Wine 24 oz.
" 14.	Died.		

There were many circumstances which led us to form a bad prognosis in this case; I would particularly specify the advanced period of fever at which she was admitted, the violence of the bronchitis, and great rapidity of pulse. Among the secondary diseases of typhus, there are few more dangerous than the bronchial affection, or one that demands the same decision in treatment *in the earlier periods of the case;* and there can be little doubt that had the chest been relieved by proper means, within the first week of this woman's illness, the chance of recovery would have been much greater.

It will be recollected that the pulse, on the thirteenth day of fever, was 140; and that after 24 oz. of wine had been given, it fell to 128: so far there was evidence that the wine was acting well; and on the fourteenth and fifteenth days there was an improvement in her condition generally. The respirations, however, became more and more difficult, and she sunk with all the symptoms of suffocation.

In the cases detailed in the beginning of this paper, it will be seen that the returning impulse and sounds were accompanied by other and decided marks of improvement; but here we had the action of the heart suddenly becoming less frequent and much more vigorous, with preservation of both sounds, while the catarrhal symptoms were increasing. The heart was not merely restored to its natural standard, so far as impulse and sounds were concerned, *but it was obviously excited;* and this excitement continued for four days before death.

The action of wine upon the heart in typhus may be said to be both sedative and stimulant; sedative in diminishing its frequency, stimulant in restoring its impulse and muscular sounds; but in its favourable action, the vigour of the impulse, and the intensity of the sounds do not pass the limits of health.

There is a point where its stimulating effect should cease, and if this is passed, wine is either useless or injurious.

I have now given such cases as I conceive are sufficient to introduce the subject of the state of the heart in typhous fever to the consideration of the profession. I might add other cases, but they do not elucidate any new point, and I have given the results of the fatal cases.

If we examine authors on the subject of the state of the heart in

typhus, we find, that, with the exception of Laennec and Louis, there is but little information given. Laennec does not seem to have examined the point to any extent; and Louis contents himself with recording the state of the heart in a certain number of subjects who died of fever; but in neither author do we find observations on the physical phenomena of the heart during life.

In his chapter on Softening of the Heart, Laennec writes as follows:

"The variety of softening which accompanies idiopathic fevers does not in general present any change of colour in the heart, or it is attended with a deeper colour than natural, approaching purple; sometimes, however, it is yellowish. I think it may be compared to that adhesive softness of the other muscles, often observed in these cases, and which is also accompanied by a degree of redness greater than natural. This softening of the heart, as well as the analogous gluey or fishy state of the muscles, is particularly observable in putrid fevers, more especially when these exhibit the phenomena formerly considered as marks of putridity, viz. livid intumescence of the face; softening of the lips, gums, and internal membrane of the mouth; black coating on the tongue and gums; earthy aspect of the skin; distended abdomen; and very fœtid dejections. I cannot assert that this softening of the heart exists in all kinds of continued fevers, but I have met with it constantly in such cases as I have attended to; and I have always thought it more marked in proportion as the signs of an alteration in the fluids were more evident. Could it account for that frequency of pulse which exists sometimes for several weeks in convalescence from fevers, although the patient continues to regain flesh and vigour?"

I shall next quote from Louis—Dr. Bowditch's translation:

"The heart had the size, consistence, and colour natural to it in half of the cases, or in twenty-three subjects; rather less frequently, *ceteris paribus*, among those who died between the eighth and twentieth days of disease, than among those who died after this epoch.

"It had less consistence than natural in twenty-four other subjects. This diminution of consistence was slight in seven cases, and as when in this degree one might consider it less as a morbid state than as a variety of the natural consistence, or as it is called, of its physiological state, I shall not consider these cases in what follows, and thus the number of patients we must examine is reduced to seventeen.

"The softening of the heart was, moreover, very slight in two of these cases. But as it was limited to the left side of the organ, we cannot consider it as the result of natural disposition; but there is a still more important reason for this opinion, viz. it happens sometimes, when the softening is considerable, that it is more so at the left than at the right. In the other cases, it was universal and very marked, the heart was very flaccid, so that in many cases it had no precise form, but like a wet cloth, retained any shape into which it

might happen to be placed. Its substance, in these cases, had very little power of cohesion, was easily torn, and was very easily penetrated by the finger.

"At the same time that it was softened, the heart had less colour than usual in many cases; it was of an onion-peel colour, which varied in intensity, and was generally livid and purplish on its surface as in its substance. The internal face of the ventricles and auricles was, on the contrary, of a deep violet-red colour, which colour sometimes penetrated beyond the lining membrane, and appeared owing to an imbibition of blood, which it resembled more or less in colour.

"When thus softened and pale, the heart had no longer, when cut, the slightly moistened aspect it has generally, but it was, as it were, dry and unpolished, such as we have seen the liver appear in analogous circumstances. Its size was not larger than usual, and it appeared smaller in two cases (Obs. 14, 33), and, therefore, it appears to me, we ought not to consider this as an effect of the softening of the organ, but rather as a natural *disposition* which existed in other patients likewise, in whom the heart presented nothing else remarkable, (Obs. 31, 39, 41).

"Another fact, which it is important to notice is this, viz., that in nearly all the cases of softening, the walls of the ventricles were evidently much less thick than usual, those of the left especially, which were often three lines thick only. And as this diminution of thickness was limited to cases of softening, we must consider it as a morbid affection.

"If these facts are insufficient to enable us to discover the cause of the softening of the heart, at least they exclude the idea of one of those affections which usually cause a great number of affections, viz., inflammation. For how can we allow that inflammation is the cause of an acute softening, accompanied by a diminution of thickness, paleness of colour, and a kind of dryness of the texture which is the seat of it? Such a supposition would truly imply a contradiction, and, as I remarked in relation to the softening of the liver, if we knew any cause of disease exactly the reverse of inflammation it would be proper to refer this softening to it.

"Other considerations which I have already given in relation to the spleen support these reflections. The walls of the heart, although more or less softened, had never any pus in them, and there was never any inflammation of the pericardium, which would have been the case rather frequently in softening of the heart, had this softening been caused by inflammation. And in opposition to this opinion, we cannot produce cases of pericarditis observed after other acute diseases, inasmuch as softening of the heart was found in two cases out of eight in which there was pericarditis.

"Moreover, the frequency and severity of the softening were much more marked according as the disease was more early fatal. Thus the heart was softened in nearly half of those patients who died between the eighth and twentieth days of disease, in a third of

those who died during the following period, and in a somewhat smaller proportion among those who died afterwards. Besides, in seven cases in which the softening was extreme, not one was relative to individuals who died after the thirtieth day of the disease, and I found

4 out of 17 patients of the first and second series,
3 " 20 " third "

"Hence we see, that whatever was the degree of softening, the proportion of cases in which it took place in the different series of patients was very nearly the same; and it was like that of the liver and spleen, more serious in those who died early in the disease, than in those who died after the twentieth day, and we did not find it at its *maximum* in patients belonging to the fourth series. The rapidity of its development showed the extreme violence of the cause to which it was owing in certain cases, and as other lesions of the same kind, it necessarily contributed much to produce death and hasten its arrival.

"Another fact which seems to me to be not less remarkable than the rapid softening of the heart is this, viz., no similar lesion was found in any other muscular organ; as all the muscles which preside over voluntary motions preserved, amidst the general disorder, the consistence and colour which are natural to them."[1]

In these extracts I have given all that has been discovered on the subject; no series of observations on the action of the heart in typhous fever has been published; I have commenced this inquiry, and have sought to derive some important indications of treatment from the existence of the phenomena now described. In the present state of the inquiry I wish it to be understood, that my observations are to be taken as referring principally to the epidemic of last year. Further researches must be made to establish how far they may be applicable to typhus in general; but I have little doubt from studying the researches of Louis, and connecting the facts relative to the anatomical state of the heart, with those now observed as to its vital phenomena, that my observations will be found to have a very extensive application.

The epidemic of last year was marked by all the signs of putridity. Dark coloured and abundant petechiæ; sordes of the mouth, fœtor of the surface, extreme prostration, and stupor, were the prominent features of the disease; and in many cases bronchial and gastro-enteric irritation existed to a great degree.

In many of the cases the bad symptoms were developed at an unusually early period, yet though recovery by crisis was by no means common, the convalescence was generally satisfactory, and the ultimate restoration to health complete. In several instances the disease was traceable to contagion.

We may thus arrange the cardiac phenomena obtained in our typhous fever:—

1. Impulse and sounds remaining unaltered; the action of the

[1] Louis. Bowditch's translation.

heart corresponding with that of the pulse.

2. Vigorous impulse, with distinct and proportionate sounds, with absence of pulse for many days.

3. Diminution of both sounds of the heart, with absence of great diminution of the impulse, (fœtal character).

4. Diminution of the first sound; with cessation or great feebleness of the impulse.

5. Complete extinction of the first sound, the second remaining clear.

6. Predominance of the first sound, the second being extremely feeble.

Of these the fourth and fifth were the most common.

I have before remarked, that in the progress of a single case we may observe first one and then another of these groups of signs. Thus in the third case, (see page 8,) the sounds on the seventh day were proportionate, but so much diminished as to resemble those of the fœtal heart. On the eighth day this character was lost, and both sounds were much louder, with returning impulse; while on the eleventh the second greatly preponderated. Nearly the same phenomena were observed in the fourth case, (see page 11,) and in he seventh, (page 18). In the case of T. Keefe the second sound was most distinct in the early periods of the case, while the first became predominant towards its close.

In the great majority of cases, however, the phenomena were as follows:—

I. Diminished impulse.

II. Diminished first sound, particularly of the left cavities.

With respect to the impulse we arrived at some unexpected results. In most cases, considered through the whole progress, the diminution and return of the first sound were accompanied with the diminution and return of the impulse. So far the phenomena were what we might expect. *But in some instances, at particular periods of the case, this accordance between the impulse and sound did not exist.* In the second case, (page 7,) the sounds became distinct before the impulse returned. In the third case, (see page 9,) the impulse became distinct on the eleventh day, while the second sound greatly predominated. In the fourth, (page 11,) we found that on the eighth day the sounds were not in proportion to the impulse; and on the tenth, the impulse continued, but the first sound was totally absent. On the next day no impulse could be felt, yet the first sound was feebly audible. In the fifth case, (page 15,) the impulse on the twelfth day was less perceptible than on the day previous, but the first sound had more strength.

It is difficult, or impossible, in the present stage of the inquiry, to offer any satisfactory explanation of these apparent anomalies; but it seems certain, that under the influence of the typhoid condition, the heart may have sufficient force to give an impulse with little or no sound, on the one hand; and on the other, its contractions may be accompanied by a sound, although the impulse be absent. Whether we are to explain these facts by referring to particular

states of innervation of the heart, or to organic alteration in the muscular fibres, or their connecting cellular membrane, is still to be determined.

My friend Mr. Hopper has suggested, that, if there be any anormal liquid secretion between the muscular fibres, the production of sound might be materially interfered with, though the muscle might contract with a certain degree of vigour. In two of our fatal cases, we found that there did exist a liquid tenacious secretion in the fibres of the left ventricle; and it becomes a question, whether the softening of the heart in typhus is dependent on an alteration of the muscle itself, or an infiltration between its fibres. Analogy would lead us to conclude, that in the early stages of the alteration at least, the fibre itself is but little affected; and the fact of the rapid restoration of the functions of the organ, in the convalescence of fevers, and the occasional excitement of the heart before death, seem to point out, that *in such cases* the injury of the muscular fibre itself has not proceeded very far.

That the cause of the want of impulse, and feebleness or cessation of the first sound, is a softening of the heart, I have no doubt. The evidences in favour of this opinion may be thus stated:—

I. That softening of the heart exists in typhous fever as a local disease, and without any analogous condition of the muscles of voluntary life.

II. That in our dissections in the last epidemic, we met with this softening of the heart, in cases which during life had presented the phenomena in question.

III. That the physical signs indicate a debility of the left ventricle principally, and it is this position of the organ which is most often altered in consistence.

IV. Laennec has stated, that in proportion to the severity of the putrescent phenomena, is the liability to softening of the heart. And the same observation is found to be true of the physical signs now described.

If this softening of the heart be one of the secondary diseases of typhus, we should, as in the case of other lesions, observe something like periodicity in its phenomena. It should appear at a certain time, and decline after its proper period had expired. I have analysed my cases with a view to these points, and the result is, that in most instances the signs of diminished impulse and first sound were developed at or about the sixth day, and the heart seemed again healthy at or about the fourteenth day. It is difficult to determine the period of the first development of the signs in many cases, as they existed on the admission of the patient, but still taking in these cases the dates of the disappearance of the signs, we get the following general results:—

Average date of appearance, sixth day.

" date of cessation, fourteenth day.

One case has been excluded from this analysis; the patient was admitted on the tenth day, and the heart was not reported healthy till the twentieth.

We thus get, as the duration of the phenomena, a period of about eight days. It is very probable, however, that the disease begins to be developed before the sixth, and that it subsides before the fourteenth day; for, as physical signs are our only means of detecting it, it is not likely that they would be well marked in its very first development, or indicate exactly the time of its subsidence.

In the softened condition of the ventricle, particularly the left, we have the explanation of the diminished impulse and first sound, and a new evidence of the truth of the theory which attributes the first sound to the ventricular contraction; and the theory which explains the second sound by the reaction of the arterial column of blood on the semilunar valves, receives also from these facts an additional though indirect verification. With respect to the second sound, we must consider it in two sets of cases: first, where both sounds were equally diminished, and secondly, where the first greatly predominated. The phenomena of the first class might seem explicable, by referring to the diminished vigour of the ventricular systole and diastole, which would affect the physical relations of the arterial column, as noticed in the Report of the London Committee of the British Association, communicated at the meeting of 1837; but when we find, in many cases, that the first sound became greatly diminished, or even extinct, while the second remained clear, we encounter a difficulty. In the second class of cases, of which I have recorded but two examples, we have no means of explanation, unless by assuming that there existed a diminished resiliency of the arterial trunks.

I am decidedly of opinion, that we cannot consider the softening of the heart in typhus as the result of carditis; it seems rather to be one of that class of affections not yet sufficiently examined, in which an infiltration of some peculiar substance takes place under the influence of the typhoid condition.[1] This occurring in the heart seems to impair its functions to a great degree; but the rapid restoration of the heart to health points out that the disease has not materially impaired its organic condition. It is obvious that we can never meet with the affection in a very advanced condition, for death by syncope would occur after the contractility of the heart had been altered up to a certain point.

Finally, I would draw the particular attention of my readers to the fact, that in the great majority of these cases the use of wine was followed by the happiest effects. I may safely refer to the cases in proof of this proposition; *and I believe that in the diminished impulse, and in the feebleness or extinction of the first sound, we have a new, direct, and important indication for the use of wine in typhous fever.* In some cases the existence of these phenomena at an early period of the disease, led us to anticipate the bad symptoms, and to commence in good time the use of the great remedy;

[1] On this point it will be seen that I adopt, with respect to the heart, the views which Dr. Staberoh, of Berlin, has put forward with reference to the follicular disease of the intestines in typhus. See his paper, Dublin Medical Journal, vol. xiii.

and in others, notwithstanding the existence of severe visceral irritations, the use of stimulants has been adopted with the best success, from the same indication.

It will be seen that the quantity of wine employed in the foregoing cases was considerable. I shall exhibit in the following table the quantity given, the day on which its exhibition was commenced, and the period of the fever, as nearly as we could calculate it.

NAME.	QUANTITY OF WINE.	DAY OF COMMENCEMENT OF WINE.	DURATION OF FEVER.
Cavanagh,	26 ounces.	8th day.	13 days.
Wright,	36 "	14th "	22 "
Devereux,	42 "	14th "	16 "
McKone,	60 "	12th "	16 days; wine continued to the 20th day.
Wallace,	66 "	11th "	18 days.
Kain,	88 "	9th "	16 "
Smyth,	144 "	10th "	18 "
Edwards,	156 "	10th "	20 "
Quin,	158 "	5th "	14 "
Hickey,	170 "	7th "	17 "

These cases may serve as illustrating the line of treatment which we adopted in our last typhus. In no epidemic did I ever before give so much wine. I never had such success in treatment. The list might be greatly enlarged, but no advantage could be gained by so doing. One case, however, may be mentioned, in which the whole quantity of stimulants employed was greater than in any of those now detailed. The patient was an elderly woman, who was admitted after having been three weeks ill, in a state of extraordinary prostration. There were no decided petechiæ, and the fever was of a more purely nervous character than is common. The disease ran on to nearly six weeks. The following is the account of the stimulants employed:—Wine, 292 oz.; brandy, 20 oz.; porter, 7 bottles; ethereal enemata, 2; jelly, beef tea, &c.

Her recovery was perfect.

The form of fever under which this woman laboured has been but rarely observed in our wards; it is characterised by extreme adynamia *unaccompanied by the phenomena of putrescence;* its duration is much longer than that of the ordinary disease, its termination less critical, and it seems uncomplicated with any distinct visceral affection. If any disease deserves the name of a "pure nervous fever," this one does. The disease to which it is most closely allied is the febris lenta nervosa of Frank, but it differs in the absence of signs of abdominal irritations.

In this patient the disease ran on to nearly six weeks; the principal symptoms being extraordinary prostration, coldness of the surface, feebleness and irregularity of the heart's action; and it was not until the end of the eighth day of the exhibition of wine, and other stimulants in great quantities, that any favourable influence was produced on the circulation; and the case strongly illustrates the advantage of persisting in the supporting system, although no amendment seems at first to follow its employment.

If, on the one hand, an inflammatory and excited condition is not produced; and if, on the other, the vital powers, though greatly sunk, are preserved from further sinking, we have an indication that stimulants are to be continued in their original, or in increasing doses.

I may now state the conclusions to which we have arrived from our investigations of last year:—

1. That the condition of the heart in typhous fever must be determined by the application of the hand and stethoscope, the pulse being an uncertain guide.

2. That a diminished impulse, or a complete absence of impulse, occurs in certain cases of typhous fever.

3. That in such cases we may observe a diminished first sound, or even an absence of the first sound.

4. That both these characters may exist with a distinct pulse.

5. That although in most cases the diminution of the impulse and first sound co-exists, yet that impulse may exist without corresponding first sound, and conversely, that the first sound may be heard although unaccompanied by impulse.

6. That these phenomena are most evident as connected with the left side of the heart.

7. That when the impulse and first sound are lessened or lost, the return to the healthy character is observed first over the right cavities.

8. That in some cases both sounds are equally diminished.

9. That in a few cases the first sound preponderates.

10. That these phenomena indicate a debilitated state of the heart.

11. That they may occur at an early period of the disease, and thus enable us accordingly to anticipate the symptoms of general debility.

12. That the existence of these phenomena, in a case of maculated adynamic fever, may be considered as pointing out a softened state of the heart.

13. That this softening of the heart seems to be one of the secondary local lesions of typhus.

14. That the diminution or cessation of impulse, the proportionate diminution of both sounds, or the preponderance of the second sound, are direct and nearly certain indications for the use of wine in fever.

I cannot conclude this paper without bearing testimony to the singular zeal displayed in this investigation, by many gentlemen who fulfilled the duties of clinical clerks during the last year. To Dr. Bovelle, of Barbadoes, and Mr. K. Kowalewski, of Warsaw, I am deeply indebted. And I beg also to mention the name of Messrs. W. M. Murphy, Thomas Moore, James Brady, Thomas Rogers, and W. Barrington, gentlemen whose practical knowledge of medicine, charity to their patients, and devotion to science, have earned for them the respect and admiration of all who were cognisant of their unostentatious exertions and untiring zeal.

ON

PERFORATIONS OF THE STOMACH,

FROM

POISONING AND DISEASE.

BY ALFRED S. TAYLOR.[1]

Much has already been written on perforations of the stomach; but it is a subject which still appears to me to demand investigation. The great difference of opinion, among many eminent authorities, as to the origin of some of the morbid changes observed in the stomach, and the difficulty of forming a diagnosis between perforation from poisoning and disease, show that we have yet much to learn. Perforation from natural causes has, in more than one instance, been mistaken for perforation from poisoning; an error which is easily accounted for, when we consider the circumstances under which diseased perforations frequently manifest themselves, and the appearances in the body with which they are attended.—A case, that will be more particularly related hereafter, occurred during the last summer; and in this, combined, with a somewhat similar train of symptoms and appearances, there were strong moral grounds to justify a suspicion of poisoning. The investigation of this case led me to turn my attention particularly to this subject; and I have here collected some cases and observations, which, if they do not add to what is already known, may at least serve to draw the attention of others to the importance of these enquiries.

Perforation of the stomach, leading to fatal peritonitis, from extravasation of the contents of that organ into the peritoneal cavity, is a most insidious disease, the existence of which is scarcely suspected until the alarming symptoms which it occasions show that the patient is beyond the reach of medical treatment. This disease presents the following general characters of irritant poisoning:—1. It commonly attacks a person apparently in good health. 2. The symptoms are, chiefly, violent pain in the abdomen. With or

[1] Guy's Hospital Reports, Aug. 1839. p. 8.

without vomiting. 3. These symptoms are often suddenly developed soon after a meal. 4. The case proves rapidly fatal; death commonly taking place in from eighteen to thirty-six hours, which is about the period within which arsenic destroys life. Besides these characters, which may well render a diagnosis often uncertain during life, there are morbid changes in the stomach that sometimes closely resemble those produced by the more powerful irritants. There are, it appears to me, four cases in legal medicine wherein a knowledge of this subject will be required of a medical practitioner:—

1. A person may have died from perforation of the stomach through disease, and not from poison.

2. A person labouring under the disease may be the subject of poison.

3. A person labouring under the disease may have received blows or injuries on the abdomen: in which case it will be necessary to state whether the perforation did, or did not, result from the violence used.

4. Perforation of the stomach from post-mortem changes may be mistaken for perforation from poison.

One case I have purposely omitted, because I do not think it likely to occur; namely, that perforation from poisoning should be mistaken for perforation from disease. So far as my knowledge extends, there is no case of this kind on record: and we shall see hereafter, that when the stomach has been perforated by poison, the symptoms and post-mortem appearances are, in general, such as to leave no doubt of the real cause of the perforation. In the four cases which I have supposed, a diagnosis is indispensably necessary to the course of justice, when a criminal charge is raised; and the first case is that which most seriously demands the attention of the practitioner; since it is not merely of the most frequent occurrence, but, if moral circumstances exist to support the suspicion of poisoning, it is very apt to mislead even a shrewd and experienced witness. There are other morbid appearances of the stomach, arising from disease, which simulate strongly the effects of irritant poisons; but it is not my purpose to enquire into these. The remarks in this paper are intended to refer to those changes only which are more or less connected with perforation of the parietes of the organ.

PERFORATION FROM POISONS.

Poisons are capable of inducing perforation of the stomach in two ways:—1. By corrosion. 2. By leading to ulceration, and the destruction of the parietes in a circumscribed space by that process. —Some poisons have a powerfully corrosive or destructive action on the living fibre; such is the case with the concentrated mineral acids and alkalies, corrosive sublimate, nitrate of silver, and a few others. The action of these poisons, in corroding the living organs, is purely chemical, and takes place immediately on contact. During

life, the action of the corrosives is known by the symptoms *immediately* following the injection of the poison; and after death if this have taken place speedily—which is commonly the case when the poison is swallowed in a large dose or in a highly concentrated state—by the distinct traces of their chemical action on the mouth, fauces, œsophagus, and stomach. Other poisons appear to have a purely irritant action, giving rise to inflammation and its consequences: they do not chemically corrode or destroy the parts with which they come in contact. This description applies to arsenic and the salts of barytes, among the more common poisons; but all the corrosives when taken in a diluted form, are capable of acting as irritants. In estimating the action of poisons on the stomach, we must then consider whether the substance taken be of a corrosive or irritant nature.

The *perforation by corrosion* is the most common variety of perforation from poisoning; and as its name implies, it is a simple result of the chemical action of one of the corrosive poisons on the stomach. Among these, the mineral acids are commonly taken or administered; and of the mineral acids we might point to the sulphuric, as furnishing us with the most frequent examples of this kind of lesion. Perforation, in this form of poisoning, is not unusual when it has been swallowed in a concentrated state; if taken, diluted—or if, at the time, the stomach be filled with food—then the parietes may escape destruction.

The characters of the aperture are these:—It is generally large and wide, occupying sometimes a considerable extent of the organ. The mucous membrane around is of a dark-brown or black colour, having, for a considerable space, a sooty appearance. This black matter which results from altered blood, as well as from the carbonising action of the acid on the mucous membrane, is often disposed in insulated or striated patches, taking the course of the rugæ. On removing this, if life have been sufficiently prolonged, marks of inflammation may be found beneath; but this is by no means constant. The edges of the aperture are rough, irregular, and often softened and pulpy. The action of the acid will be found to extend through the œsophagus, into the fauces; and as a portion generally escapes from the stomach through the opening, the adjacent organs are frequently affected by its corrosive action. The perforation is produced either immediately or very soon after the ingestion of the acid; and death is commonly a very speedy consequence. The acid may be, in general, easily detected, either in the contents of the organ, or, if these have escaped, in the liquid effused in the abdomen or pelvis. If no liquid can be discovered, a small portion of the corroded mucous membrane, digested in water, will yield traces of its presence.

Among the preparations of the museum, is one marked 1799[32]; which is the stomach of a man who destroyed himself by swallowing concentrated sulphuric acid. The stomach was extensively perforated by the corrosive action of the poison. It presents the

characters above described. Death, in this case, took place very speedily.—The drawing marked 304 represents the interior of the same stomach. The brownish-black extravasation is here very well displayed. The mucous membrane is free from all appearance of vascularity. Its vessels are strikingly brought out by the action of the acid upon their contents. The aperture in the stomach is large, nearly circular, and situated at the cardiac extremity.—The drawing marked 303 represents the effects of the acid, which escaped through the perforation, on the liver, spleen, and pancreas.

One dram and a half of concentrated sulphuric acid was given to a rabbit; the animal did not appear to suffer much pain: the abdomen swelled considerably; death speedily took place; and on inspection, the cardiac extremity of the stomach was found extensively destroyed. A large irregular opening had formed; the edges of which were softened, pulpy, and of a black colour. The mucous membrane was not in the least reddened; but the blood-vessels ramifying over the stomach were prominent, and their contents appeared dark-coloured, and consolidated. The acid had partly escaped into the abdomen, and had attacked the surrounding viscera; the marks of its action were distinctly traceable, through the whole course of the œsophagus, to the fauces and mouth. The contents of the stomach, as well as the coats of the organ, gave the clearest evidence of the presence of sulphuric acid in large quantity.

Nitric acid is capable of perforating the stomach like the sulphuric; but it is a poison not often taken, and therefore we cannot speak as to the frequency of perforation by it in the human subject. Among the cases collected by Orfila, there is only one in which perforation was observed. The aperture in the case of nitric acid presents all the marks of corrosion; and the edge is generally tinged of a yellow colour; or if bile be present in the contents of the stomach, then the mucous coat may have a greenish hue.

Half a dram of nitric acid was given to a rabbit. The abdomen began immediately to swell as in the former experiment. The animal did not appear to suffer any pain; it became insensible and soon died:—a small quantity of vapour escaped from the nostrils. On inspection, the stomach was found softened, tinged yellow, but not perforated; which I attributed to the large quantity of food present in the cavity. Nitric acid was detected in the stomach; and the marks of its action were very apparent in the mouth, fauces and œsophagus. All these parts were corroded, and tinged of a deep yellow.

Oxalic acid is said to have occasioned perforation of the stomach; but this appears to be a rare circumstance. A solitary case is referred to by Dr. Christison; but he does not seem to have met with any instance of the kind, in the course of his own observations. In many experiments on animals, and in some few observations on the human subject, I have found nothing to bear out the view, that perforation is an effect of this poison. In a concentrated state, it

corrugates; and softens the mucous coat, so as to render it easily removable by pressure or friction; but I have not observed any breach of continuity in the coats:—the substance of the stomach beneath has always been firm.

We have but little knowledge of the effects of the alkalies, as corrosives, in the human subject. Orfila thinks, chiefly from experiments on animals, that potash, of all corrosive poisons, most frequently perforates the stomach. In the only two experiments on dogs reported by him, one was attended with perforation; and the other, not. The aperture is described as having been eight lines in diameter, circular, surrounded by a projecting livid hard border; and situated near the pylorus. The mucous membrane of the œsophagus and stomach was of a deep-red colour throughout.

Besides the above mentioned substances the bichloride of mercury, nitrate of silver, and perhaps the sulphate of copper, might be ranked among the common poisons capable of perforating the stomach, by corroding its parietes. The nitrate of silver and sulphate of copper are so seldom taken as poisons, that the idea of their perforating the stomach is founded more on the knowledge of their chemical properties, than on any experience of their action on man or animals. Neither Orfila nor Christison reports a case in which these substances produced perforation of the stomach. Our remarks may then be confined to corrosive sublimate.

Comparatively speaking, corrosive sublimate is not often taken as a poison; but when introduced into the stomach, it is liable to perforate the organ, by corroding its parietes to a greater or less extent. This accident is, however, rare; and is only likely to be witnessed when the poison has been taken in a very large and concentrated dose. Out of many cases reported by Orfila, there is not a single instance in which perforation was produced by it; and Christison alludes to one only. The reason why corrosive sublimate so rarely perforates the stomach, is properly ascribed to the facility with which it is decomposed, and rendered inert, by the mucus and other contents of the organ. Although the characters of the aperture produced by it are not described, yet the perforation may be expected to be accompanied by great vascularity of the stomach and œsophagus, with other unequivocal marks of poisoning.

We have next to speak of perforation from ulceration caused by irritant poisons. This may be regarded as an extremely rare variety. Those substances which destroy the stomach by corrosion are capable, when diluted, or taken in less concentrated doses, of giving rise to ulceration of the coats; the eschars first formed, sloughing off. Of all the irritants—and, indeed, it may be said of all poisons—arsenic is the most frequently taken. Notwithstanding this, cases in which it has produced ulceration are not common; and those in which the ulceration has proceeded so far as to perforate the coats, are very rare. Death usually takes place long before the process has advanced to this degree. Out of a great number of specimens in the Hospital Museum illustrating the

effects of arsenic on the stomach, there is not one in which this organ has been perforated. It is by no means unusual, in toxicological works, to find perforation described as one of the effects of arsenic. Thus Orfila mentions this among the post-mortem appearances met with in arsenical poisoning; but the statement is not supported by a single case. Out of the numerous cases reported by him, there is not one in which perforation occurred. Dr. Christison has met with one instance; and he refers to two others which occurred abroad. In a case of alleged poisoning by arsenic we must then remember that perforation of the stomach is an extremely rare appearance. Indeed the discovery of this state of the organ ought, in my opinion, to lead us to suspect, *cæteris paribus*, that death may have been due to morbid causes, and not to poison. The only other common irritant which is alleged to have produced perforation is the muriate of barytes; but the solitary case which is reported by Wildberg is far from bearing out this view. The facts rather tend to show that the perforation either existed, or was actually being produced, when the poison was swallowed.

Such then is the history of perforation of the stomach as occasioned by corrosive or irritant poisons. The variety most likely to present itself in practice, is that dependent on the action of sulphuric acid; but its characters are so prominently marked, that it is difficult to understand how it should ever be mistaken for the effect of disease. We have to remember, that when perforation is thus caused, death is usually a speedy consequence; the corrosive action of the poison is discoverable in the fauces and œsophagus, as well as in the stomach; if any have escaped through the aperture, the surrounding viscera will also be attacked, and present evident marks of corrosion. In the perforation from ulceration by poison, well-marked characters may be wanting, and the aperture more closely resemble that observed in certain forms of disease; but the previous history of the case, the manner in which the symptoms occur, their order and succession, as well as the morbid changes throughout the whole alimentary canal, will, with a chemical analysis, remove any disease that might arise. Thus, then, we feel justified in saying that perforation from poisoning is not likely to be mistaken for the effect of disease. The difficulty, if any, would exist in the case of irritant poisons, where the stomach alone was examined, and the state of the œsophagus and the intestines, with the previous history of the symptoms, was left wholly out of consideration. By the creation of a series of possibilities, we might form a case, wherein a diagnosis would be difficult, if not impossible; —as where the person is found dead, and no account of the circumstances under which death took place is to be obtained. Arsenic may really have caused death :—none may be found in the stomach, which we will suppose to be perforated; and the alimentary canal may not present those well-marked characters of inflammation which we commonly meet with. The admission of all these facts merely shows that a case may, by possibility, occur, in which

neither medical nor general evidence can furnish satisfactory proof of the cause of death. In the mean time, the life of no person is compromised, and no error is committed; there is a simple want of evidence to establish a supposed crime; for which deficiency a medical practitioner cannot be held responsible. When it is affirmed that the perforation from poisoning may be confounded with that from disease, the opinion seems to me to have arisen from the fact, that the stomach alone has been submitted to examination, and that all the collateral circumstances, indicative of poisoning, have been excluded. Now, although a diagnosis may be in some instances obtained when the examination is thus restricted, it appears certain that, in others, the examiner is very liable to be led into error.

The next branch of the enquiry involves greater difficulties; and therefore requires a somewhat closer examination, since it is here that mistakes are most liable to occur. Perforation of the stomach may take place from causes independent of poison, and the symptoms and appearances sometimes closely simulate those of poisoning.

PERFORATION FROM MORBID CAUSES.

Perforation of the stomach may be a result—1. Of simple ulceration; sometimes of an acute but more commonly of a chronic character; 2. Of scirrhous ulceration; 3. Of a solution of the parietes, which is supposed to take place after death.

Ulceration of the stomach, proceeding to perforation, is one of the most formidable and insidious diseases. It often attacks persons, more especially females, in the prime of life, and in the full vigour of health; and previous to the sudden and fatal illness, there will be no warning of the impending danger. In general the previous symptoms are only those of dyspepsia, or ordinary derangement of the stomach; the illness is so slight, as not commonly to attract the notice of those with whom the person is living. The following case will show the usual course of this disease:—

"The deceased, a girl aged 21, residing in the neighbourhood of Guy's Hospital, and assisted her father in conducting his business. She appeared to have generally enjoyed good health; but had latterly felt occasional nausea, with frequent craving for food of which she could take but little. She had had one or two attacks of pain in the abdomen, which she referred to articles of food that had disagreed with her. Some castor oil gave her relief. One morning, while walking in her usual health, she was seized with sudden and acute pain in the abdomen, chiefly referred to the right iliac region. When seen, she was extremely faint, and covered with a cold perspiration. Vomiting came on: and the vomited matters were of a bilious character. In spite of the application of proper remedies, the symptoms continued without diminution, and she died about forty-two hours from the time of her seizure, evidently

from peritonitis. Nothing had passed through her bowels during the whole of the atttack, although castor-oil had been administered. Previous to death, she complained of great pain between the shoulders; and very soon after death, the skin, at this part, became extremely livid.

Sectio Cadaveris.—The body, generally, was pale. The abdomen was much distended. On opening it, a considerable quantity of dirty liquid was found in the peritoneal cavity. On the surface of this, a quantity of oil floated—the castor-oil which the deceased had taken shortly before death. The peritoneal surface of the intestines was in many places mottled with numerous small spots of a florid red. There were, likewise, many flakes of tender coagulable lymph. The stomach was feebly glued to the concave surface of the liver, which was pale. On the cardiac side, and on the lesser curvature of the stomach, there was a small opening through the parietes, about large enough to give passage to a crow-quill. The mucous membrane of the stomach, at the spot corresponding to the external opening, presented a circular patch of ulceration, about half an inch in diameter, with clearly defined and not elevated edges. The opening in the muscular coat was of less diameter; and near the centre of this was the hole through the peritoneal coat already described. At a short distance from this ulcerated opening was a much smaller patch of ulceration, about the size of a split pea. This was confined to the mucous coat: it was circular, and had a well-defined border. For some distance around these ulcers the mucous membrane was speckled with small opaque white points, but little elevated, and scarcely perceptible to the touch. The mucous membrane was healthy; but there was a slight redness around the ulcerated aperture. The interior of the alimentary canal was in other respects healthy.

This was a case of perforation from simple ulceration, proving fatal by peritonitis. There was no scirrhous hardening of the border of the ulcer, nor any appearance to indicate that it was of long standing. The portion of the stomach with the aperture may be seen in the preparation marked 1806[24]; and the appearance of the mucous membrane, in the recent state, is illustrated by the drawing 298.

Dr. Abercrombie mentions a case similar to this, of a young woman, aged 18, who, although troubled with variable appetite, appeared generally in good health. She was seized suddenly with the most violent pain and vomiting, and died in twenty-nine hours from peritonitis. On the upper part of the smaller curvature of the stomach, near the cardia, there was a perforation which admitted the point of the little finger. Internally, this opening communicated with an ulcerated space, about the size of a shilling, with slightly-thickened edges. In other respects the stomach was healthy. Other cases, very similar in their symptoms, progress, and post-mortem appearances, are referred to by this author.

It is not so common to find the aperture one of simple ulceration.

It is, I believe, more generally of a chronic and scirrhous character; the margin, including the coats of the stomach for some distance round, having often a hardness almost cartilaginous. The application of the term "scirrhous" to this kind of perforation may be objected to by those who limit it to cancerous disease; but as the word is merely intended to distinguish those forms of perforation which are accompanied by a hard border, with a thickening of the parietes of the stomach, from perforation through simple ulceration, in which the parietes are unaffected, there can be no harm in retaining it; more especially since it is, in this sense, frequently employed by practitioners. Besides, it would not be easy to draw a line of distinction between these cases and those strictly termed scirrhous; for, obviously, the mere extent to which the parietes of the stomach are diseased cannot be a fair ground of difference.

Dr. Abercrombie enumerates three kinds of ulceration of the stomach, which may lead to perforation:—1. Small defined ulcers, with evident loss of substance, and round and elevated edges; the stomach healthy. 2. Ulcers of about the size of a shilling; the parietes of the stomach being thickened and indurated for some extent around. 3. Extensive and irregular ulceration of the inner surface of the stomach, generally complicated with thickening and induration of the coats and fungoid elevations. This division appears to me to justify the distinction above drawn, as to the varieties of perforation.

It is not my intention to speak here of cancerous disease of the stomach, since this cannot be easily confounded with the effects of poison. The long-standing nature of the disease, the well-marked gastric irritation, and the constitutional disturbance, with the morbid appearances after death, must at once indicate the cause of the symptoms and death. Dr. Carswell has remarked, that, in these cases, a communication with the abdomen does not commonly take place; since, as the structure of the stomach is destroyed, the parietes of the organ become glued to the surrounding viscera. The preparation marked 1813[66] shows the degree to which malignant ulceration of the stomach will extend. The whole tract from the œsophagus to the pylorus is involved; the coats are destroyed in places; but throughout there are strong adhesions. The preparations 1802[84] and 1806[4] show apertures resulting from ulceration, which have been closed by adhesions. These are interesting; because they will account for the fact, that an individual may be seized with alarming symptoms resembling irritant poisoning, at one period of his life, from which he may recover; and subsequently die of another disease. A remarkable case of this kind is mentioned by Dr. Abercrombie. The subject of this was a gentleman, aged 60. He ultimately died from peritonitis, through perforation. On inspection, one aperture was found sealed up by the liver; while another, of recent formation, situated near to it, had led to the fatal symptoms.

In pursuing the subject of scirrhous perforations, or those

accompanied with thickening and induration of the parietes of the stomach, to a greater or less extent around the ulcerated opening, I shall now describe a series of cases, of recent occurrence; so that we may endeavour to determine from them whether any well-defined diagnosis can be established between the disease and irritant poisoning.

In the following case, the deceased, aged 22, was a steady healthy young woman, acting as housemaid in a family in the neighbourhood of London. One morning, after breakfast, she complained of intense pain in the left hypochondriac region, accompanied with flatulence. Her bowels being confined, she took some tincture of rhubarb. In the space of half an hour, the intensity of the pain subsided; but there was great uneasiness, with distention of the abdomen. She was not seen by a medical man until about twelve hours after her first seizure: her pulse was then small and quick; there was great prostration of strength, great tenderness over the whole of the abdomen, coldness of the extremities, and general pallor. She was bled: leeches and warm fomentations, with other means, were used to relieve her sufferings, but without effect: the symptoms continued, with but little abatement, until the following morning, when she died; *i. e.* about twenty-six hours after the first attack.

Sectio Cadaveris.—The body was examined twenty-nine hours after death. On laying open the abdomen, the peritoneum had a general blush of redness over its surface, but there was no agglutination of parts. The liver was remarkably pale. Three quarts of fluid, resembling a mixture of turbid serum and ill-formed chyme, were removed from the cavity. On exposing the stomach, a small opening was found on its anterior surface, about two inches below, and rather to the right of its junction with the œsophagus. The circumference of the opening was thickened; and the diameter was about an inch on the outside, and about an inch and a half on the inside; so that the mucous membrane, as is frequently the case, had been removed to a greater extent internally than the peritoneal covering, externally. The small intestines were nearly empty: the large, loaded with scybalæ. The rest of the abdominal viscera were healthy. The stomach is preserved in the Museum, and may be seen in the preparation marked 1806[60].

From the account given by the fellow-servants, it appeared that for the three or four months preceding the attack, the deceased had complained of pain in her left side, uneasiness after her meals, flatulency, and habitual constipation.

There are many other preparations which give a good idea of the characters of this kind of perforation, but the history attached to which is somewhat imperfect. 1806 represents the stomach of a person who died in thirty hours from the first attack. The opening is about half an inch in diameter externally, but larger internally.—1806[12]: In this the stomach is seen perforated, in the smaller curvature. The aperture is about the size of a crow-quill. The

surrounding parts, for some distance, are thickened and indurated. The mucous membrane is generally thickened, granular, and rugous. It was taken from a middle-aged man, who died very suddenly, and had previously complained of but slight indisposition.—1806[3]: A similar preparation; the aperture is about half an inch in diameter.—1802[78]: The aperture in this stomach is of an oval form, and is situated near the cardia. The mucous membrane appears thinned.—1806[36]: The ulcerated aperture is here situated in the smaller curvature, about one third from the pylorus. It is much larger internally than externally; and on the mucous membrane is circular, about two thirds of an inch in diameter. Somewhat nearer the cardiac orifice there is a much smaller spot, from which the mucous membrane is partially removed.—1804[48]: This stomach presents two ulcers of a scirrhous character; one of which has perforated the organ.

Among the cases which remain to be alluded to, are the following:—

A girl aged 18, who had laboured some months previously under slight gastralgia, was suddenly seized with the most acute pain in the umbilical region. Vomiting supervened: the pulse became quick, small, and depressed: the abdomen tender, and the extremities cold. The bowels were only slightly open. No treatment gave relief; and, after the most intense suffering, she died twenty-four hours from the attack. On inspection, it was evident that the deceased had died from peritonitis; the contents of the stomach having become effused through an opening in the lesser curvature of the stomach, near the œsophagus. The aperture was circular, about the size of a duck-shot, and had a dark margin. The stomach was slightly adherent, in this spot, to the under surface of the liver. Internally, the diameter of the aperture was greater, so that the ulcerated opening was funnel-shaped from within outwards. Before death, she complained of pain between her shoulders. This case occurred to Mr. Prichard of Leamington.

S. M., a female aged 25, was suddenly seized with severe pain in the region of the stomach and nausea, after eating a small portion of lobster. She was seen by Mr. Bibley in about an hour and a half, when she complained of great pain in the abdomen, and between her shoulders. Her countenance was much sunk: there were cold perspirations, tenderness of the abdomen, and a small and feeble pulse. Medicines were exhibited with but little effect; the pain between the shoulders became much more severe; the bowels were not opened, but the vomiting abated. She gradually sank, and died in twenty-one hours from the time of the attack. Mr. Bibley ascertained that about three months before she had some dyspeptic symptoms, which disappeared under treatment. Her health seemed to have been otherwise good. On inspection, adhesion and agglutination of the peritoneum were found, and two quarts of fluid were effused in the cavity. On the anterior and upper part of the stomach there was an ulcerated opening large

enough to admit the thumb. It was of a circular form; the circumference hard and thick: internally, it was irregular. The posterior wall of the stomach presented another ulcer of nearly similar dimensions. The mucous membrane was not vascular.

A young woman, aged 22, who had previously laboured for some months under slight dyspeptic symptoms, was suddenly seized shortly after breakfast, at which she had taken a single cup of tea, with violent pain in the lower part of the abdomen. When seen by a medical man, her extremities were cold, her pulse 120, low and feeble. There was great tenderness of the abdomen; and continual retching, without the power to vomit: the bowels were moderately open. The pain, which became very severe, was relieved by opium. Intense thirst came on, so that she took five pints of lemonade during the night. She died in twenty-one hours from the first attack. On inspection, the abdomen was found filled with a turbid fluid: there were slight adhesions, with coagulable lymph. In the lesser curvature of the stomach, about midway between the cardia and pylorus, there was a circular opening about the size of a shilling. The edges were smooth, stiff, and almost cartilaginous: they were partially adherent to a thickened and solidified portion of omentum. There was no appearance of ulceration, nor any other lesion of the mucous coat, with the exception of two or three minute points of a vivid scarlet, near the cardiac orifice.

A female, aged 18, after eating a hearty supper of beef and potatoes, of which four other persons of the family had partaken, was seized with severe vomiting, and violent pain at the stomach. During the day, she complained of pain in her side, but had performed her work in her usual health and spirits. She had no sleep during the night; and on the following morning, early, she walked a distance of a quarter of a mile, to her home. Mr. Cripps of Liverpool, who was called to her, found her lying with the knees drawn up, and her face expressive of great anxiety. The abdomen was distended, and tender on pressure: pulse 138: intense thirst, and bowels confined. The symptoms continued to increase: she experienced great pain in all her joints, especially in her shoulders; and in spite of treatment, she sank, and died about twenty-four hours after her first seizure. The body was inspected thirty-four hours after death. Marks of acute peritonitis were found in the abdomen. The stomach was perforated in two places; one perforation being on its anterior, and the other on its posterior wall. The coats of the organ, for some extent around the perforations, were thickened and hardened. The posterior opening, which was about the size of a shilling, was sealed up by adhesion to the pancreas, which was also diseased. The anterior opening was smaller: through it the contents of the stomach had escaped, and caused the fatal peritonitis.

A young woman, aged 21, stout and healthy looking, had experienced for some months pain in her left side, and uneasiness in

her stomach after eating; when one afternoon, after drinking a cup of hot tea, she suddenly screamed out, and complained of the most violent pain in her stomach. Whatever she drank, was instantly rejected. When seen by a medical man, she was found labouring under cold shivers, hurried respiration, and her pulse scarcely perceptible. At every inspiration, she complained of great pain in the back, and between the shoulders. She continued to discharge, by vomiting, a yellow bitter liquid, like bile. The bowels remained obstinately constipated: she died, as it was presumed, about thirty-seven hours of the attack. On inspection, the whole peritoneum was found highly inflamed. A perforation was discovered in the stomach, between the cardia and pylorus, nearer to the former: it was about half an inch in diameter, and of an irregularly circular shape. The mucous coat which was partially thickened, was found removed to a greater extent internally than the peritoneal externally; and the latter was thinned off. The mucous membrane of the pyloric half of the stomach presented numerous minute points of ulceration; and two or three detached patches of redness, about an inch in diameter.

A young woman, aged 20, was seized with violent pain in the region of the stomach, about half an hour after breakfast. She vomited every thing she attempted to swallow: her bowels remained obstinately confined. There was great pain, with tenderness, in the abdomen: and there were all the symptoms of severe peritonitis. She died in twenty-four hours from the first attack. The symptoms and death were acounted for by the discovery of two apertures in the stomach. One was situated at the posterior part of the lesser curvature, about midway between the cardia and pylorus, and was about the size of a pea. Directly opposite to this, in the anterior part of the stomach, was another opening, about the size of a shilling; with smooth defined edges, presenting the appearance of having been cut with a sharp instrument. The mucous membrane was corrugated, but neither reddened nor ecchymosed in any part. Mr. Crisp, to whom this case occurred, ascertained that for eight or nine months previously the deceased had generally suffered from pain and vomiting after eating. The suspicion of poisoning was so strong, that it was considered necessary to remove it, by analysing the contents of the stomach. No poison was found.

The following case shows that the disease occurs in the aged and in the male sex, without any difference in its characters. A temperate man, aged 60, acting in the capacity of gardener, after complaining two or three days of loss of appetite and shivering, was suddenly seized, while at work, with the most excruciating pain in the abdomen. Symptoms of peritonitis came on, under which he died in twenty-four hours. There was no vomiting, and the bowels were obstinately confined. On inspection, an aperture was found in the smaller curvature, near the pyloric orifice. It was surrounded by a thick fleshy circle, forming a ring.

Numerous other cases might here be brought forward; but it appears to met, hat the foregoing, which are of recent occurrence, and well authenticated, are sufficient to warrant us in drawing a few conclusions respecting the characters of this remarkable disease, so that we may contrast them with those peculiar to irritant poisoning.

1. Perforation of the stomach seems to attack frequently young females from 18 to 23 years of age, generally unmarried. According to Andral, females who have been recently delivered, and those persons who have undergone severe operations, are likewise subject to it. The disease is not exclusively confined to females, or to a particular age. In the preceding observations, two cases of males, at 60, have been referred to.

2. The preceding illness is commonly slight, rarely amounting to more than simple dyspepsia or slight irritation of the stomach after eating, with want of appetite. These symptoms may have existed for some weeks or months before; but have been altogether disregarded, and perhaps not even noticed by those, with whom the deceased associated. In other cases, the gastric disturbance is more severe; but as a medico-legal fact, it is important to remember, that these cases, with severe precursory symptoms, appear to constitute the smaller number. Dr. Abercrombie remarks, that "this affection may run its course, almost to the last period, without vomiting; and with scarcely any symptom, except the uneasiness which is produced by eating, and which subsides entirely a few hours after a meal." Some have considered that a chlorotic state of the system might dispose young females to this affection; but there does not appear to be any sufficient ground for this opinion. It has happened, in some few instances, that chlorosis co-existed with this disease of the stomach; but in others, the females are described as having been stout and healthy. Besides, the same disease, with the same characters, occurs in male subjects at various periods of life.—Evidence is then wanting to show that there is any connection between chlorosis and a tendency to this disease of the stomach.

3. The individual is suddenly seized with the most severe pain in the abdomen, generally soon after a meal. It seems probable that this pain takes place at the moment the parietes of the stomach give way, and the contents of the organ are effused into the peritoneal cavity. The pain is of that excruciating kind, that the individual feels, unless it be removed, he cannot long survive. The attack coming on soon after a meal, may be, perhaps, dependent on the coats of the organ having become so thinned at the spot, that the slight action required for chymification may lead to the entire destruction of the thinned peritoneal tunic, which at this time must form the only partition between the cavity of the stomach and that of the peritoneum. At other times, the occurrence of the attack under these circumstances seems to be a pure coincidence; as where, for instance, in one of the cases the perforation took place immediately after a cup of tea had been swallowed. We cannot

be surprised, however, that poison should be suspected to exist in the food, when an individual, apparently in full health, is suddenly seized with such alarming symptoms; and therefore the greater caution is required in investigating the case. We ought to be well aware of all the particulars, before we countenance, in the least degree, the suspicion of poisoning; and among the diagnostic marks of the disease, we must not therefore forget the suddenness of the occurrence, and the intensity of the pain.

4. In several of the cases reported, pain in the abdomen was accompanied or succeeded by pain between the shoulders. How far this deserves to be regarded as a pathognomic character, must depend on further observation; but its having been already so frequently met with, seems to render it something more than an incidental occurrence. The pain in the abdomen commonly undergoes a remission before death; and the mental faculties are usually clear until the last.

5. There is commonly vomiting; this, however, is sometimes absent; and in other instances very slight, the stomach simply rejecting what may be given as medicine or food. There is no diarrhœa; in general, the bowels are obstinately confined. The symptoms, after the first attack, when carefully examined, are those of peritonitis, not of irritant poisoning.

6. Death takes place in from eighteen to thirty-six hours: in most of the cases mentioned, death occurred within twenty-four hours. The time at which the disease proves fatal, closely approximates to that at which a person dies in severe cases of arsenical poisoning.

We may next direct our attention to the appearances met with in the dead body.

1. On opening the abdomen, there are all the marks of severe peritonitis:—effusion of serum, with coagulable lymph; agglutination of the viscera; and extravasation of the contents of the stomach.

2. An aperture in the stomach, of an oval or rounded form; its shape depending, in some degree, on the manner in which the parietes of the stomach are placed, to observe it. It is commonly from half an inch to an inch in diameter; and is situated in or near the lesser curvature, between the cardia and pylorus. This almost constant situation of the ulcerated aperture is a circumstance worthy of remark. It has not, as yet, so far as I am aware, received any explanation from pathologists. The edges of the aperture are smooth, soft, and fleshy-looking. The tunics appear to be thinned off, from within outwards; so that the mucous membrane is usually removed to a greater extent than the muscular coat; and this than the peritoneal coat. The last is thinned off to a sharp edge, so that there is no appearance of laceration or ulceration. Near the circumference of the aperture, the coats of the stomach are thickened, sometimes hard, and even cartilaginous. This thickening may be disposed in a slight ring, or extend to some distance; and it may be confined to one part of the circumference, or extend all round. I

have here described what I have actually seen; and although I do not presume to say that these are the invariable characters of the perforation, yet they agree closely with the descriptions given by other and more experienced observers than myself. The hardening and thickening of the parietes of the stomach, around the aperture, seem to indicate what Andral long ago stated—that the ulceration is of a chronic character. The smoothness of the borders of the aperture renders it probable that the tunics are gradually thinned off by slow absorption; and that before the perforation is complete, the peritoneal coat is reduced to the thinnest stratum of membrane. Were it not so, we should expect to find the margin always fringed and lacerated; an appearance which is not, I believe, very usually observed. The peritoneal coat does not seem to have undergone laceration or rupture, but to have become entirely removed. In some cases, where this fringed appearance has been met with, the circumstance may probably be explained by some mechanical cause having accelerated the rupture of the thinned membranes. Dr. Abercrombie thinks that the smoothness of the edges of the perforation is to be accounted for by supposing them to have cicatrised.

When the aperture is the result of simple ulceration, then the appearances will be modified:—there is no thickening of the coats of the stomach, and marks of ulceration are apparent. The edge of the aperture may be very slightly or not at all raised above the surface of the surrounding membrane. Several cases of this kind have been adverted to, and are illustrated by the museum preparations.

Sometimes there are two openings in the stomach near each other: or, instead of the second opening, there may be marks of ulceration scattered over the organ.

3. The mucous membrane of the stomach is either pale or presents slight patches of inflammatory redness over its surface; sometimes the margin of the ulcerated aperture is slightly reddened, the other parts of the stomach being healthy.

From the description here given of perforation as a result of ulceration, in the stomach, it is scarcely possible to conceive that it should be confounded with perforation as a result of corrosive poisons, such as sulphuric acid. The general evidence may or may not show that some such substance had been taken recently before the appearance of the symptoms. If this be proved, the enquiry is at an end; if it be not proved, then an examination of the mouth and fauces, as well as of the matters vomited, consisting of shreds of membrane and altered blood, and abounding in sulphuric acid, will convey something more than a suspicion of poisoning, while the individual lives. Under any circumstances, an individual whose stomach is thus perforated is not likely to survive long: and after death, the discovery of the corroded state of that organ, and perhaps of the surrounding viscera, as well as of the œsophagus

and fauces—with the detection of the acid by analysis, in the corroded parts, or in the liquids extravasated in the abdomen—will remove any doubt that might remain. With regard to the detection of the poison, either the individual will have vomited, or he will not: if he have vomited, then the vomited matters will furnish abundant evidence of its presence; if he have not vomited during life, then the acid will be easily discovered, in analysing the corroded viscera of the abdomen, or their extravasated contents.

It may not be so easy, however, to distinguish a perforation resulting from this disease, from one produced by the action of an irritant like arsenic. Arsenic is selected as an example, because it is so common a poison, and because the symptoms of the disease may be supposed to resemble particularly those produced by this poison. To form a diagnosis for medico-legal purposes, let us take into account the following circumstances:—

1. Perforation of the stomach is comparatively frequent as a result of disease. We have also seen that it is apt to attack a particular class of persons; namely, young females. Perforation is so rare an effect of arsenic, that, out of a vast number of accurate reports of by death this poison, there are not, so far as I am aware, more than three cases in which this morbid change has been observed; and only one of these occurred in Britain. This fell under the notice of that accurate observer, Dr. Christison. Here, not the smallest doubt could exist that arsenic had been administered, and was the cause of death. The question of the origin of the perforation which was about the size of a pea, and situated in the anterior wall of the stomach, was not entered into at the trial; but there seems no reason to doubt that it resulted from the action of the poison.

2. In perforation from disease, the symptoms may not occur until three or four hours after any substance has been swallowed. In arsenical poisoning, the symptoms commonly occur in about half an hour after the substance containing the poison has been taken. Sometimes this criterion will not be available: since, as we have seen by the reports of several cases, the attack commenced within a short time after a meal. It is well to bear in mind, however, that arsenic does not commonly produce symptoms immediately, nor is it usual to find their appearance delayed for several hours.

3. In perforation from disease, the pain in the abdomen occurs suddenly, and is of the most intense character. It is sometimes felt in the lower part; and at others, over the whole of that cavity. In arsenical poisoning, the pain comes on gradually, slowly increases in severity, is commonly described as of a burning kind, and is chiefly confined to the region of the stomach. Gerard, long ago, suggested this sudden occurrence of severe pain as a characteristic of perforation from disease. Chaussier denied that this was a criterion; because certain cases had occurred in which this symptom did not exist. Although, from some cases to be hereafter related, it would appear that extensive disease, even to perforation, may go on in the stomach, without any indication from symptoms during life,

yet it is probable that Chaussier classed what are now regarded as post-mortem perforations among those resulting from disease. The objection here, however, amounts to nothing; since we are speaking of the diagnosis of those cases in which pain has been actually felt. Besides, it is not more probable that pain will be absent in cases of diseased perforation, than in cases of arsenical poisoning; and a suspicion of poisoning would not be likely to arise, where no pain was felt.

4. In perforation, vomiting, if it exists, is commonly slight; and it is chiefly confined to what is swallowed. There is no purging: the bowels are generally constipated. In arsenical poisoning, the vomiting is usually severe, and diarrhœa is seldom wanting.

5. The time at which death takes place in perforation, is in from eighteen to thirty-six hours, very often within twenty-four hours. This is certainly the average of severe cases of arsenical poisoning: but the question now more particularly to be considered, is, how far arsenic may have been the cause of a perforation found in the stomach? Can arsenic produce perforation of the stomach within twenty-four hours? This is a question to which medico-legal reports will only allow us to return a speculative answer. In the solitary case of perforation produced by arsenic, to which I have alluded, the individual survived four days: and as arsenic is not a corrosive poison, it seems probable that some time must elapse before the morbid changes produced by it in the stomach will have proceeded to such a degree of intensity as to lead to their destruction. In the absence of more cases, illustrating this rare effect of arsenic, our judgment ought to be suspended; but this we may safely say, of the number of reported cases, in which arsenic has destroyed life within twenty-four hours, in not one instance has the stomach been found perforated. In a somewhat doubtful instance of perforation by arsenic, alluded to by Foderé, the individual lived sixty hours. We must then attach some little value to the shortness of the period within which diseased perforations destroy life, from the time of the first appearance of the symptoms.

6. In perforation, peritonitis is the sole cause of death. In arsenical poisoning, the fatal result takes place under the peculiar symptoms produced by the poison.

On inspection of the body the stomach is found perforated. The following characters may perhaps assist us in forming an opinion of the cause of perforation.

7. In diseased perforation, marks of severe peritonitis are discovered in the abdomen, effusion of turbid serum and lymph, with agglutination of the viscera. The peritoneal coat of the small intestines is found inflamed. In perforation resulting from arsenic, we may also find marks of peritonitis; but this must depend greatly on the time which the person survives after perforation has taken place. Peritoneal inflammation appears to have existed in Dr. Christison's case; but along with morbid changes of this descrip-

tion there were those due to the action of arsenic alone. In this instance, the deceased was not seen till after death: therefore it is not easy to say, whether she died directly from the effects of the poison, or from peritonitis induced by extravasation of the contents of the stomach, owing to the poison having caused perforation of its coats. The symptoms, so far as they could be collected from description, were more or less vomiting, purging, thirst, and general uneasiness:—these certainly are the symptoms of poisoning by arsenic.

8. In diseased perforation, the mucous membrane of the stomach and small intestines is not commonly inflamed. There may be circumscribed patches of redness in the stomach, or a faint diffused redness; or the ulcerated aperture may be surrounded with a more or less vascular areola. In perforation from arsenic, we may expect to find the mucous membrane of the stomach and duodenum highly inflamed, more especially that of the stomach. The fauces, œsophagus, and rectum, may also be inflamed. In Dr. Christison's case the surface of the stomach was very vascular, marked in different places with dark-brown spots of various sizes, and here and there abraded. The intestines were internally very red. The circumstance of perforation occurring, does not then interfere with the presence of the usual post-mortem changes of poisoning by arsenic; on the contrary, as there is reason to believe that at least two or three days would be required to bring about perforation, the effects of the poison ought within that time to become well marked. In forming an opinion from the state of the mucous membrane it must be borne in mind, that in perforation from disease, the stomach is sometimes vascular; and that in arsenical poisoning, unaccompanied by perforation, the mucous membrane has been found, in some very rare cases, to be free from vascularity.

9. It has been said, that a diagnosis might be formed from the appearance of the aperture: but this is somewhat doubtful. It unfortunately happens, that only one side of the question has, as yet, received the attention of pathologists; cases of perforation by arsenic being so extremely rare. 1. *Situation.*—In perforation from disease, the aperture is commonly placed in or near the lesser curvature; but arsenic may perforate the parietes in any part of the stomach. In Dr. Christison's case, the perforation was in the anterior wall. 2. *Size.*—No criterion exists on this ground. In the above case, the aperture was about the size of a pea—the size which is often found in perforation from disease. In regard to other characters, we may observe, that, in perforation from disease, the border is sometimes smooth, presenting no mark of erosion; it is thickened; and the thickening extends occasionally, for some distance around, into the parietes of the stomach, which are indurated. In the case of perforation by poison, already alluded to, the aperture had a dark ragged margin. The inner coat was more extensively destroyed around it; but this, we have seen, is commonly met with in perforation from disease. The parietes of the stomach are not

stated to have been thickened and indurated: but this is an effect which may follow the action of arsenic, of which a striking example was reported in a late number of this Journal (April 1837).[1] The thickened part of the stomach may be seen in the Preparation marked 1798[80]. It is, however, a question worthy of consideration, whether the aperture produced by arsenic can ever possess the smooth well defined border which is occasionally seen in that from disease. Will not the aperture from arsenic always present the marks of erosion, or of rapid destruction?—If this question be answered in the affirmative, we may have the means of distinguishing, at least, some perforations resulting from disease. The perforation by arsenic, it must be remembered, is produced in two or three days, or even in a shorter period: that of disease is commonly the result of insidious morbid action, slowly working for several months. We may then expect, pathologically, that the apertures will present somewhat different appearances, from the very different circumstances under which they are produced. Until more cases of well ascertained perforation by the irritants have occurred, it is difficult to say how far the observation of the aperture will be practically available in forming a diagnosis. Some have asserted, that the presence of two apertures will justify an opinion in favour of their origin from disease; but this is surely an error: for if arsenic may produce one perforation, why may it not two, or more? In one of the cases referred to by Dr. Christison, the stomach was perforated by numerous small holes; so that, when held before the light, it appeared riddled, like a sieve. Again; the discovery of patches of ulceration on the mucous membrane does not favour the suspicion of the aperture having resulted from disease: for if arsenic can produce perforation in one part of the organ, it may, by its irritant effects, easily produce ulceration in other parts; and of the two, ulceration is more commonly produced by it than perforation.

10. In perforation from disease, no poison will be discovered in the stomach or intestines. In perforation from poison, we may expect that the application of appropriate tests will lead to its detection, either in the matters vomited during life, in the contents of the viscera after death, or in the substance of the viscera themselves. Accordingly, in two cases of perforation, of which we have a history, arsenic was discovered in the perforated stomachs in one, both in the contents and in the parietes. On the other hand it may be said, arsenic is not always discoverable in the stomach, even where it has been taken in large quantity, and has undoubtedly caused death. For a remarkable case of this kind, see Guy's Reports, Vol. II. p. 78. To account thus for the absence of poison in a case of perforation, and still maintain that arsenic had caused the aperture, would, in the absence of strong corroborative evidence, certainly be taking every advantage of an exception;—a proceeding occasionally justifiable, in criminal charges. This line of accusa-

[1] Vol II. p. 70.

tion would, however, be entirely defeated, if the practitioner had taken the precaution to analyse the matters vomited during life;—a duty which should on no account be omitted, where the slightest suspicion of poisoning arises. Let us assume that arsenic had really been the cause of perforation: it follows, if the person have vomited, that the poison will be found in the vomited matters: if he has not vomited, or vomited but little, then we may expect certainly to find it either in the stomach or its contents, after death. Vomiting sometimes continues for days in arsenical poisoning, without effectually clearing the stomach of the poison. In general, the absence of poison from a perforated stomach ought to be taken as a fair presumption against the origin of the perforation from poison.

Lastly: Let us suppose that the fatal symptoms first showed themselves within half an hour after a meal, a case in which there would be, *cæteris paribus*, the strongest ground to suspect irritant poisoning;—we sometimes have it in our power to rebut this suspicion, by a very simple investigation. Others probably partook of this same meal in company with the deceased, without manifesting any symptoms of disturbance. This must be conclusive against irritant poisoning, more especially if we examine a portion of the food taken. When the deceased has taken food alone, chemical evidence cannot be dispensed with; but when in company with others, the simple fact, of no other but the deceased having afterwards suffered, will go to disprove the fact of poisoning.

The previous symptoms of perforation from disease are so slight, that the discovery of their existence can benefit us but little in our diagnosis. Dyspepsia is so common among individuals, that but little stress could be laid upon this having existed for some time prior to the fatal illness. A person whose stomach was perforated by arsenic might really have suffered from all the symptoms which precede the formation of an ulcerated aperture in the stomach. But when, in addition to other facts favouring the opinion that the perforation was caused by disease, we find the deceased to have laboured, for some months preceding the attack, under loss of appetite, acidity and uneasiness, and a distension of the stomach after eating, we have strong additional evidence to support the opinion, and to lead us to pronounce for disease.

Such, then, are the circumstances which we have to guide us, in forming a diagnosis in these obscure cases. By a careful investigation of the symptoms and appearances, it is not easy to conceive that much difficulty will commonly arise.

A medico-legal question may incidentally occur in relation to perforation of the stomach; namely, whether an individual labouring under it has the power to perform acts of volition and locomotion? This question we are able to answer in the affirmative. In one of the cases which has been reported, it was clearly ascertained, by the surgeon who attended the deceased, that she walked to her

home, at the distance of a quarter of a mile, after she had been seized with the first alarming symptoms.

One of the most remarkable facts connected with perforation of the stomach from disease, is, that the process of destruction may advance so far, without being indicated by a symptom sufficiently striking to attract notice. This is a point of some importance, when we attempt to found a judgment on post-mortem appearances only; as also where a counsel in sustaining a charge of poisoning against an accused party, would endeavour to draw a statement from a medical witness, that extensive disease in the stomach, leading to perforation, would not be likely to have existed without symptoms indicative of mischief. But, as preceding observations show, the fact is exactly the reverse; the non-existence of previous alarming symptoms does not in the least degree favour the assumption of poisoning. The following case, which occurred in the hospital, a few years back, will show that ulceration of the coats of the stomach may proceed, almost to their entire destruction, in the ulcerated spot, without being indicated by a symptom.

The deceased was a middle-aged man, of a spare habit, and had formerly acted as a carrier. His habits had been irregular. When admitted into the hospital, he had a sore on his leg; his extremities were anasarcous; and he laboured under great general indisposition. There was oppression of the chest, with cough, and sanguinolent expectoration. There was nothing to lead to the suspicion that his stomach was diseased. The man did not long survive his admission. On inspection, disease of the chest was found to exist, sufficient to account for the urgent symptoms. On examining the stomach, the mucous membrane was throughout reddened. At the smaller curvature, near the pylorus, there was an ulcer, nearly circular, about the size of a sixpence, and without elevated edges. Its surface was of a light yellowish colour; and was depressed below the level of the mucous membrane, by about the thickness of the membrane. The other viscera, with the exception of the kidneys, were healthy.

The model 2772[1] represents the stomach in its recent state. The preparation 1801[32] shows the stomach itself, with the ulcer.

Had there not been other organic disease to destroy life, this man might have become the subject of perforation, when, for the first time, the existence of the disease would have been suspected. The redness of the mucous membrane seems to have been unusually great in this case: it seems, besides, diffused over the whole stomach. Indeed, so far as appearances go, the stomach might have been easily taken for one acted on by arsenic: this will be strikingly seen on comparing the model with the other models showing the effects of that poison on the stomach. This could not have been mistaken for a case of arsenical poisoning, because there was not a symptom to indicate irritation of the stomach during life; and no poison would have been discovered by chemical analysis, had it been resorted to.

It would appear, from a case observed by Dr. J. Beck, that not merely ulceration, but perforation of the stomach, may take place, and no pain or other symptoms be experienced, unless the contents be effused into the peritoneum. Indeed, death may, in such a case, be a result of a totally different cause. The subject of this case was a female, aged sixty, labouring under hydrothorax: she had no pain in the stomach, and was neither troubled with nausea nor vomiting. She died in a few days, evidently from disease of the chest. On inspection, the stomach was found perforated in the lesser curvature, midway between the cardia and pylorus; the aperture being about the size of a shilling. On laying open its cavity, the mucous membrane was highly vascular; and there were four other ulcers along the lesser curvature, the edges of which were a good deal thickened, and very smoth. All of them were surrounded by vascular borders. The stomach contained about a pint of fluid: none of its contents had escaped into the abdomen. The other viscera were healthy. An enquiry into the previous history of the deceased showed that she had never complained of pain or uneasiness in her stomach, and that her appetite had remained good until within three or four weeks of her death. This is a very remarkable case; and it illustrates some points of great importance in a medico-legal view:—1. That perforation from disease may take place without exciting a symptom. 2. That the stomach may, under this morbid condition, present marks of great vascularity. 3. That the perforation may take place without the contents becoming extravasated. 4. That a person may labour under perforation of the stomach, and yet die from another cause. In such a case, a suspicion of poisoning could have been entertained by those who judged from the appearances in the stomach only:—the history of the case, during life, would at once have rebutted it. Perforation of the stomach from disease cannot therefore be said to present any difficulty to the medical jurist, unless peritonitis follow. It is the rapid death, under symptoms of violent irritation, from a state of health, that excites suspicion.

PERFORATION BY SOLUTION.

This kind of perforation is often called spontaneous; because, formerly, it was thought that, with this exception, all apertures in the organ resulted from the action of corrosive substances. But the perforation by simple or scirrhous ulceration might with equal reason be called spontaneous. Chaussier, and other French writers, class under the head of "spontaneous" all that are not produced by poison. There is considerable doubt, among pathologists, as to the circumstances under which, and the time at which, this kind of perforation takes place. Some regard it as the result of disease in the parietes of the stomach, analogous to softening in other organs, and consider that the aperture is formed during life: others, on the contrary, believe that it is a simple post-mortem change, resulting from the action of the gas-

tric secretions on the coats of the stomach after death. The latter is the view more generally adopted by English pathologists; a circumstance which has induced me to give to this the name of "perforation by solution." There are, it appears to me, difficulties to the admission of either view exclusively; but, before noticing these, it will be perhaps better to state the characters of the aperture, and the means by which we may distinguish it from the perforation by poison.

This kind of perforation is generally met with at the greater extremity of the stomach, occupying sometimes a large portion of the fundus. It is large and irregular: the edges are thin, ragged, commonly much softened for a considerable space around, and present that fringed appearance which the stomach might be conceived to acquire by the scraping of its parietes with a blunt knife. So far the characters may be well seen in the Museum preparations marked 1802[12], and 1802[24]; and several other preparations, which I have had an opportunity of seeing in the museums of this country and the continent, are perfectly similar. Never having met with this condition of stomach in the recently dead subject, I must avail myself of the observation of others to complete the description. The mucous membrane around the aperture is stated to have sometimes a black or brown colour; and the blood in the vessels, ramifying on the coats, is similarly changed. The mucous membrane of the whole stomach is pale, and free from vascularity: indeed, Dr. Carswell, who adopts the view of chemical solution, asserts "that redness, whether arising from the effusion of blood or vascularity, is incompatible with perforation from this natural chemical agent." It is clear, that if it be a post-mortem change only, it cannot be accompanied with vascularity; or that the vascularity, if it exists, must be incidental, and depending on some other cause. The contents of the stomach are not always effused; and when they are, there is no evidence of peritoneal inflammation, nor any morbid change whatever, to indicate that the effusion had taken place during life. The absence of all marks of peritonitis seems to indicate, in the most positive manner, either that the perforation and extravasation occurred recently before, or at some period after death. The viscera opposite the perforated spot, whether the spleen, liver, or diaphragm, are commonly found softened, and in a dissolved state; having almost the impress of having been acted on by some fluid which has escaped from the stomach. Lastly, this singular change is either not indicated by symptoms during life; or they are of so slight a kind, as to lead to no suspicion of the mischief which is going on. It is said that, in some instances, general febrile disturbance, with vomiting or diarrhœa, has shown itself: but, on the other hand, the appearance has been met with in persons who have died a violent death; and, again, in the bodies of individuals who have clearly died from disease in a remote part of the body. On the chemical hypothesis, no symptoms could be admitted to indicate it it, unless it were supposed that disease of the stomach,

favourable to the solution of the parietes, might be going on during life, either by preparing them for the more ready action of the gastric secretion, or by rendering that secretion itself more highly solvent. This, it is true, is pure conjecture; although, as we shall hereafter see, somewhat supported by facts: in the mean time, it is quite opposed to the opinion of those who rest their views upon the stomach and its secretions being in a healthy state. Thus, then, whether this perforation be vital or cadaveric, it seems clear that it is not indicated by symptoms during life, or those symptoms are of a very trivial character. So again, death does not appear to be caused by it; for there is no evidence of the deceased having suffered from peritonitis.

The preceding observations will perhaps suffice to show that this kind of perforation is not likely to be mistaken for any other, whether resulting from poison or disease. In the first place, if there be any account of the state of the person during life—of the symptoms under which he laboured, or the manner in which he died—it will be at once evident, although on inspection the stomach be found perforated, that he could not have suffered from the effects of corrosive or irritant poison. But, supposing that the evidence is confined to the dead body alone, a little more difficulty may arise from the resemblance of the aperture to that resulting from the action of corrosive poisons; and also from the singular fact, that the viscera opposite or near to the aperture have the appearance of being acted on by some corrosive substance. The mucous membrane of the stomach, in perforation by sulphuric acid, is often destitute of vascularity, and is covered around the part where it has given way, by black extravasation. In the aperture by solution, something of the same kind is witnessed; but, according to Dr. Carswell, the discolouration in the latter case is confined to the softened part of the stomach, the alteration being due to the action of the gastric acid on the blood: in the instance of sulphuric acid, it will be diffused more or less over the whole of the membrane. A far better criterion, it appears to me, will exist in examining the state of the fauces and œsophagus. If the aperture have resulted from a post-mortem change, these will be found in their usual state: if from the action of a concentrated acid, these parts will also be found softened and corroded. Should the stomach or intestines present any vascularity—should there be any marks of peritonitis from the extravasation of the contents—these circumstances will, of course, tend to show that some corrrosive poison had been swallowed; unless we adopt the very improbable view, that the perforation might still have been cadaveric, and these morbid changes coincidental. I have hitherto purposely abstained from alluding to the evidence derivable from a chemical analysis; but this we might certainly expect to show the presence of poison, in the corroded parts of the stomach, or in the contents of the abdomen. The discovery of muriatic acid in the corroded parts, without unequivocal evidence of its action on the fauces and œsophagus,

might not be conclusive evidence of poisoning, for a reason to be presently explained. Lastly, cadaveric perforation is extremely rare:—perforation from a concentrated mineral acid, a neither uncommon nor unexpected result. But we may fairly ask the question, How often shall we be obliged to trust to post-mortem evidence alone for the basis of an opinion? The occurrence of such a case is only barely possible; and therefore the difficulties just alluded to must be regarded as more speculative than real. One case may truly occur of unquestionable difficulty; namely, where, with cadaveric perforation of the stomach, we find that there have been pain and irritation in the organ during life. The discovery of a corrosive poison, either in the vomited matters, in the stomach and its contents, or in the liquid extravasated in the abdomen, would here alone save us from falling into error. The state of the fauces and œsophagus, likewise, must not be overlooked. Should these sources of evidence fail, there would be no ground for an inculpatory opinion.

Can the cadaveric perforation be confounded with that produced by irritant poisons? It does not seem possible. In the perforation caused by irritants, the individual dies evidently under the symptoms of poison: in cadaveric perforation, he dies without symptoms of gastric disturbance; or they are very slight, certainly not to be confounded with those of irritant poisoning. On inspection, the aperture from the irritants is wholly different in character: the stomach and intestines are commonly highly vascular: if extravasation has followed, then the marks of peritonitis will be perceptible: lastly, either the matters vomited, or the contents of the viscera, will yield poison, on analysis.

Neither is it easy to conceive that this kind of perforation should be mistaken for the ulcerated aperture of disease, whether dependent on simple ulceration or scirrhus. This, as we have seen, is attended during life by severe and characteristic symptoms, leading rapidly and surely to death, through peritonitis. Besides, in the perforation by solution, the viscera opposite to the aperture are commonly more or less softened and acted on. The aperture itself is also wholly different: there is no mark of ulceration, or of scirrhous hardening: on the contrary, the parietes of the organ are rendered soft and pulpy, for some distance around.

What renders the history of this kind of perforation so obscure, is its extreme rarity. The following is the only case which during a period of many years, has found its way into the records of the Museum.

In October 1828, James Boulding was admitted into the hospital, with an old ulcer on the back. He had suffered from this for some months; and it had evidently much reduced him. It appeared to communicate with an abscess, as a quantity of unhealthy pus escaped from it. In spite of every attention, he sank, and died in about a week after his admission. The day before his death, he had dark, or nearly black, vomiting: some time afterward he became convulsed, and continued quite insensible until his death; although,

by his moaning, it appeared that he was in considerable suffering. He had never before evinced any symptoms of cerebral affection.

On inspection, the lungs and brain were found in a diseased state; and there was a communication between the spinal canal and the abscess on the back. In the cavity of the left pleura there was a large quantity of dirty brown fluid, on which oily matter was floating. This led to a supposition that a communication had taken place between the stomach and the thorax: and on examination, the diaphragm was found perforated by two openings of considerable size, opposite to the cardiac extremity of the stomach. It had the appearance of having been acted on by some solvent, rather than by ulceration. The peritoneum was generally healthy: the little fluid which it contained was but slightly discoloured; and the extravasation of the contents of the stomach, which had taken place to a small extent, had probably occurred after death. A very considerable portion of the cardiac and of the stomach was softened and destroyed, so that it was extensively perforated; but, except in the immediate vicinity of the perforation, the mucous membrane did not appear deranged. The mucous membrane of the alimentary canal was also free from any morbid appearance. Both the liver and spleen were healthy, except where in contact with the cardiac portion of the stomach: here they were extremely discoloured, by the dark matter effused from that organ; but their structure, to some little depth, was much paler than elsewhere. The stomach may be seen in the preparation marked 1802[12].

Notwithstanding the irritation of the stomach which existed the day before death, as manifested by vomiting, the description of the appearances in this case seems to show that the perforation took place after death, and that it was in no way connected with that event. There were no traces of peritonitis, although the contents of the stomach had become partially extravasated; and the viscera contiguous to the great end of the stomach were softened, the diaphragm being itself actually perforated. These facts are in favour, not merely of a post-mortem origin of the perforation, but of its having been produced by some kind of solvent, acting, by contact, through an opening in one viscus on those organs situated beyond it. Could this have been confounded with perforation from any corrosive poison, or from ulceration? For reasons already assigned, it is impossible to conceive that any such mistake could have been made, even by one who was ignorant of the history of the case during life, and only had the post-mortem appearances to guide him.

A child, aged two years, of a scrofulous habit, died of phthisis, and the body was inspected thirty-six hours after death. Sufficient disease of the lungs was found to account for death. On opening the abdomen, the cardiac end of the stomach was seen to be extensively destroyed; and the edges of the perforation were irregular, ragged, and much softened; the mucous membrane being, in some parts, almost in a pulpy state. There was no mark of inflamma-

tion or disease in any part of the organ. A portion of the contents had become extravasated; but the parts with which it had come in contact were perfectly healthy, and free from any sign of inflammation. With the exception of the mesenteric glands, the other abdominal viscera were healthy.

Here again we have a case in which it does not seem possible to assign any other than a post-mortem origin to the perforation. The want of symptoms during life, and the nature of the appearances after death, clearly distinguish it from every other kind of perforation yet noticed.

The following case, mentioned by Laisné, is very similar to one just now related. A pregnant woman was seized with convulsions, and premature labour followed: she was delivered of dead twins, and died in about four hours. On inspection, the contents of the head and chest were found healthy: but in the abdomen, the stomach was perforated, to the extent of three inches, at its larger end. The edges of the perforation were thinned off, pulpy, and of a dark colour. There was no adhesion to the surrounding viscera, and no extravasation of the contents of the stomach into the peritoneum. In the contiguous part of the diaphragm there was, however, an aperture about two inches long, the edges of which were irregular, fringed, and of a dark colour, having a somewhat gangrenous appearance. The perforation occupied partly the tendinous, and partly the muscular portion of the diaphragm: the stomach projected through the opening; and there was slight extravasation of its contents in the thorax.

This case is reported by the author; and was considered by Chaussier to be an instance of perforation during life, and leading to the death of the woman. It corresponds so closely, in its details, with the foregoing cases, as irresistibly to lead to the conclusion, that the aperture must have depended for its origin on a similar cause, and have taken place under similar circumstances.

It will now be necessary to say a few words on the probable cause of this perforation; as, notwithstanding the well marked characters which distinguish it, it is said to have been mistaken, in more than one instance, for perforation by corrosive poisons. It has been already remarked, that the opinions of pathologists are divided in respect to it. Some consider that it is the result of disease, and that it takes place during life; while others, constituting the majority, regard it as a purely post-mortem change, depending on the solvent power of the gastric secretion on dead animal matter.

In favour of the last view—namely, that it occurs after death, there are the following facts:—1. The absence of any symptoms during life, to indicate that so serious an injury as extensive perforation of the stomach, and extravasation of its contents, has taken place. Although in Dr. J. Beck's case already related, there was perforation without symptoms, yet in this the aperture was small, and there was no extravasation. The contents of the stomach are not always effused, even in the perforation by solution; but whether

they be effused or not, the lesion is unattended with symptoms indicative of so great an injury to an important organ; and thus we may regard it as improbable that it should have taken place during life. 2. Substances effused into the peritoneum during life are well known to excite peritonitis; but here liquids of the most irritating character have become effused, and no appearances of inflammation have been found in that cavity. This is not, perhaps, positive evidence of a post-mortem change, because the perforation and extravasation might be said to have occurred recently before death; and it does not seem to have been yet settled, how long a time is required for effused matters to remain in contact with the peritoneum, in order that they should leave the undisputed morbid changes of peritonitis. Again, no marks of inflammation have been found in the stomach; this point, perhaps is not yet established in the affirmative; but it is clear, if the edges of an aperture present any traces of inflammation or adhesion to the surrounding viscera, it could not have a post-mortem origin assigned to it. 3. The perforation generally occurs at the cardiac extremity; the most depending part of the stomach, where digestion is chiefly carried on. The viscera at or near the aperture are discoloured and softened; just as if some corroding liquid had escaped through the opening, and had accidentally come in contact with them. It is thus we have seen, in two cases, the diaphragm has been found perforated. 4. Experiments made on animals, and on animal matter, in relation to the gastric secretion, show that a liquid is poured out capable of thus acting on the coats of the organ after death. John Hunter first called the attention of the profession to this subject; he having found the stomach thus acted on in the case of three persons who had died a violent death, as well as in some animals killed for the sake of experiment. It was then considered that a healthy state of the body was necessary for this change to be observed; and thus the rarity of its occurrence was attempted to be accounted for. It was also believed, that, in a state of abstinence, the gastric juice continued to be secreted, accumulating more especially at the greater end of the stomach; and that, so soon as the vital properties of the organ were lost in death, its coats underwent digestion, just as its contents might do during life. Experience has, however, shown that both of these positions require to be modified. The stomach has been found equally destroyed in diseased subjects:—it has not been found destroyed in all cases of violent death, from a state of health; nor in those instances where men or animals have perished from starvation. Besides, the liquid poured out by the stomach in a state of abstinence is found to be entirely different, in its nature and properties, from the secretion which really acts upon the food introduced. After long fasting, the liquid contained in the stomach is viscid, neutral, and destitute of albumen: it yields not more than 1.64 per cent. of solid residue, which consists of the salts of ammonia, potash and lime, chiefly muriates and sulphates. Such a liquid cannot, of course, act chemically on animal matter; and thus it is

attempted to explain, why, in a large number of subjects, this perforation of the stomach is not found. When any substance is introduced into the organ—such as, mineral matter or food—a copious secretion of a liquid possessing very different properties immediately takes place. This is believed to be the true gastric-juice; it has an acid reaction, due, according to the experiments of Prout and Chevreul, to the presence of free muriatic and acetic acids. Besides these bodies, it contains mucus and salts; the latter consisting of the muriates and sulphates of potash, soda, and ammonia. The solid matter varies from 1.5 to 2 per cent.; and the proportion of free muriatic acid, as determined by Prout, in a case of dyspepsia, did not amount to more than five grains in sixteen ounces of liquid!

The effects of this liquid, considering its composition to be as thus determined, are perfectly extraordinary. Several experimentalists had remarked, that if rabbits were killed shortly after having taken food, and the bodies were examined four, six or eight hours after death, the stomach was found, at its greater end, softened, perforated, and the food projecting through the parietes, or extravasated. Litmus-paper, placed in contact with this digested food, was found to indicate acidity; and Dr. Carswell considered that the destruction of the coats was to be ascribed to the action of this "gastric" acid; because, when neutralised by magnesia, immediately after death, no softening was observed. On transferring the liquid of a healthy animal to the stomach, intestines or urinary bladder of another, it was found that softening and perforation took place. In the case of a young man who was killed by an accident soon after his breakfast, Dr. Carswell found the coats of the stomach softened, but not perforated.

Other experiments have since been made by Professor Müller and Dr. Schwann, with artificial mixtures of diluted acids and mucus, to resemble the gastric juice. Diluted muriatic acid, mixed with mucus, was found by them to have the property of dissolving most kinds of animal substances used for food, by the aid of a temperature of 98°. They consider that the acid acts, not by any corrosive property, but as a predisposing agent; and that it does not act without admixture with mucus.

These experiments bear less on the subject of our present enquiry than those performed with the gastric secretion on recently dead animals. A heat of 98° is not required, in the dead subject, for this action on the stomach to go on: if it were, the perforation would, of course, be accomplished within the first few minutes after death; whereas it appears that some hours are required: so that if the body of the animal be too early inspected, it will not be observed. In addition to this an observation made by Mr. Burns shows that there must be some difference between this process of destruction and that of digestion, unless we consider a high temperature unnecessary for the latter. This gentleman found the stomach perforated on the first examination of a human body, at the usual period after death: but when he made a second inspection, two days after-

wards, he found the stomach more extensively destroyed, and the liver acted on and softened. Besides, there is another objection to the statement of a high temperature being necessary for the destruction of this organ by its own secretion. Can we consider the stomach of a person who had recently expired, so long as it retains a temperature of, or approaching, 98°, in the condition of dead animal matter? It appears to me that we cannot; and, therefore, that no fair inference can be drawn, one way or the other, from experiments made with pieces of dried stomach in artificial acidulous mixtures.

Another material question, in reference to this phenomenon, is, Whether the gastric secretion acts on the stomach by its vital or chemical properties? Most physiologists adopt the latter view; and, indeed, we can scarcely imagine that any secretion of the body should preserve vital properties longer than the solids, or that the coats of the stomach, for instance should pass to the state of dead matter before the liquid actually secreted by them; which would be the case were we to assign this solvent action to the vital properties of the secretion. On the other hand, it is not so easy to admit that the action is purely chemical. In a chemical view the free muriatic acid of the secretion would be considered as the sole agent capable of acting on the coats of the stomach: but if the quantity contained in the secretion were ten times as great as that discovered in it by analysis, it would have but very feeble solvent powers; and certainly, as a chemical result, we should hardly expect that muriatic acid so diluted would have the power within twenty-four hours of destroying the great end of the stomach, softening the spleen and liver, and softening and perforating the diaphragm. Concentrated muriatic acid might effect all these changes; but we cannot suppose that the vessels of the stomach, in the state of health and life, have the power of secreting an acid so highly concentrated as to be capable of corroding and destroying so extensively after death, more especially when the living stomach cannot resist the action of the mineral acids, unless in a certain state of dilution. To account for this corroding property being possessed by an acid so diluted, it has been said, that the admixture of mucus converts it into a new body, which is called a digestive liquid. Those who adopt this hypothesis must of course abandon the ordinary view of the chemical action of the gastric secretion; since it would be an entirely new fact, that an inert substance like mucus should confer such remarkable powers upon an acid so diluted. Among the circumstances which yet remain to be cleared up, with regard to this doctrine, are the following:—1. Is muriatic acid capable of being detected in a free state, in any quantity, in the softened parietes of the stomach, spleen, diaphragm, or liver, when these organs are affected in the manner already described? 2. Will muriatic acid, diluted to the extent to which it exists in the gastric secretion, and introduced into the stomach of a recently-dead animal cause changes similar to those which have been observed? This

last experiment would test the correctness of the chemical doctrine, on either assumption; because in the stomach it would meet with mucus.

It was formerly supposed that the stomach should always be in a healthy state; but it is probable, as Dr. Abercrombie remarks, that in some cases this post-mortem change is preceded by disease during life;—certainly, as we have seen, it has taken place in diseased subjects. From the present views, regarding this perforation, we may never expect to find it, unless some food has been taken recently before death; for the secretion is not poured out, except by the introduction of some stimulus. Yet, if this explanation were true, it ought to be very frequently met with; for it is by no means unusual to find half-digested food in the stomach after death:—so again, in the inspection of bodies of persons who have died suddenly from disease while in the act of eating, or have been killed, soon after a meal, by accident, how seldom do we hear of the stomach being found dissolved or perforated. In the case already mentioned of James Boulding, there was no reason to suppose that he, out of many hundreds, inspected during the course of many years, should have been the only individual who took food at the very time, or whose body was inspected the exact number of hours after death required for this change to be met with. Yet, out of hundreds of subjects, who have died and been inspected under exactly the same circumstances, no other instance, so far as I can ascertain, has occurred. In one of the cases, in the human subject, observed by Hunter, the man had died by hanging;—yet a vast number of hanged subjects have been inspected since his time; and, so far as I know, not another instance has been reported of the stomach being found perforated. Is it to be supposed that, in Hunter's case alone, food had been taken the requisite time before death, and the inspection conducted at the requisite period afterwards for discovering this perforation of the stomach? We cannot assent to so improbable a view:—and if not, what becomes of the common explanation of this phenomenon, that food should be taken recently before death—the individual die suddenly in a state of health—and the stomach be in a healthy condition? It will surely be deemed inadmissible. Perhaps this explanation might apear to derive stronger support from the results of experiments on animals; but the analogy appears to me to fail, when we consider the whole of the circumstances.

These experiments have been performed on animals in the state of the most perfect health; if killed during digestion, the stomach has been found perforated: but in how many human beings accidentally killed, dying under the same circumstances, has perforation been discovered? The preceding observations show that it is an extremely rare occurrence; and that it has been as often observed in diseased, as in healthy subjects. Even previous disease of the stomach evinced by symptoms during life, is not incompatible with its occurrence.

The preceding facts and observations may perhaps be considered to justify the following conclusions :—

1. That perforations of the stomach, from solution, are very rare in the human subject.

2. That they may occur in healthy and diseased states of the body.

3. That the perforation takes place after death ; and depends on the action of the gastric secretion, which, in the opinion of some, is facilitated by a diseased state of the parietes of the stomach. But that the secretion is the chief, if not the sole cause, seems probable, from the fact, that the liver, spleen and diaphragm have also been found softened, the latter even perforated where lying near the aperture in the stomach. We must then imagine either that these accidentally contiguous parts partake of the same disease as the stomach, or that disease of that organ is not necessary for its coats to become destroyed by the secretion.

4. That the secretion cannot be the healthy gastric juice, but some altered state of that liquid. This is rendered probable by the facts—1. If it were the ordinary secretion, perforation would be much more common in healthy persons, dying suddenly soon after a meal. 2. It would not be met with in diseased subjects, or those labouring under disease of the stomach.

5. That the exact nature of the liquid producing the change, and the circumstances to which it owes its solvent power, are unknown.

We shall now consider the medico-legal applications of this subject by reference to cases.

1. *A person may have died from perforation of the stomach through disease, and not from poison.*

In June 1838, a female in a noble family, aged twenty-three, was taken ill, and died somewhat suddenly, under suspicious circumstances. She had been unwell for about three weeks, and was subject to occasional vomiting and disturbance of the stomach. Still, her illness was so slight, that it did not in the least interfere with the performance of her usual duties. On a Saturday afternoon about four o'clock, and therefore probably three hours after her last meal (although this could not be ascertained with certainty), she was taken suddenly ill, suffering from the most excruciating pain in the abdomen, and violent vomiting. The skin was cold and clammy : there were other signs indicative of a mortal collapse, and the abdomen was tender and painful. It being suspected that she had taken poison, magnesia, and afterwards sulphate of magnesia, were exhibited. No poison was found in the room, and she strongly denied the imputation. As there were some grounds for believing that she had been the subject of an improper intrigue with a male person in the establishment—and symptoms resembling irritant poisoning had occurred suddenly and without apparent cause while she was in tolerable health—it is not a matter of surprise that such a suspicion should

have arisen. In spite of treatment the symptoms continued to become worse; the vomiting was violent; and she died the following morning, as nearly as could be ascertained, about fifteen hours after her first seizure.

Mr. Hilton inspected the body, and found all the organs healthy, except in the abdomen. There were strong marks of peritoneal inflammation: the intestines were loosely adherent to each other, and a quantity of lymph was effused upon their surfaces. The cavity contained about a pint of liquid; which was collected, and reserved for analysis. This had evidently escaped from an aperture in the stomach, which was empty. The uterus was enlarged; its internal surface vascular, but presenting no appearance of embryo. The ovaries were vascular; and on one of them was seen a recent corpus luteum. The organs were in such a state, as to lead to a strong suspicion that intercourse had recently taken place.

Mr. Hilton requested me to assist him in the investigation of the case; and we accordingly examined the stomach and its contents. The stomach was laid open, by making an incision along its greater curvature; and the following appearances were met with:—At the upper and posterior part, near the pyloric end of the smaller curvature, was an opening of an oval shape, and about half an inch in its longest diameter. The edges were firm, hard, and smooth; presenting not the least appearance of laceration or ulceration, even when examined with a lens; they were beveled off from within outwards, being thinned towards the peritoneal coat; in short, the aperture presented the appearance of having been obliquely punched out; its diameter being greater internally than externally. There was no sign of inflammation in the mucous membrane, immediately around the aperture; but when examined from without the margin appeared somewhat black, compared with the general whiteness of the peritoneal surface. On cutting through the perforation, the coats of the stomach were found to be four lines thick at the lower part; and they were involved for some distance around, but were less thickened superiorly than inferiorly. At the lower part the parietes had almost a cartilaginous whiteness and hardness, and were decidedly in a scirrhous state. The mucous membrane was firm throughout; it had a somewhat yellowish tinge, but in its central portion there were slight patches of inflammatory redness, shaded off into the yellow colour. At the lower part, near the larger curvature, there were thick irregular black striæ: the mucous membrane being raised and blackened, but not in the least softened. These striæ appeared like those produced by the action of sulphuric acid; but there was no corrosion or softening; and on applying test paper, there was not the least mark of acidity. The black matter was here and there covered with a yellowish coloured substance, streaky, not easily removable, and apparently embedded with it in the mucous membrane. The appearance was similar to that produced by loosely painting a dark surface with gamboge, or mustard mixed with water. A portion of the blackened mucous

membrane, with and without the yellow colouring matter, was scraped, and cut off, but with some difficulty, and set apart for analysis.

The duodenum contained a yellowish green liquid—apparently, altered bile. Its mucous surface had a deep yellowish green colour, but there was no abnormal change.

The contents of the stomach, found extravasated in the abdomen, were first examined: they were of a dark brown colour, mixed with mucus and flocculi of lymph, and amounted to about twelve ounces. Four ounces diluted with a little distilled water, were boiled for two hours and then filtered. The filtered liquid was of a pale yellow colour, and perfectly neutral. It was tested for arsenic, sulphuric and oxalic acids, and the salts of barytes, lead, and copper; but not a trace of any of these poisons could be discovered. The liquid from the duodenum appeared to be nothing more than altered bile: it contained no poisonous matter. The yellow substance on the blackened portion of mucous membrane was next examined. The mucous membrane containing it was boiled for an hour in distilled water acidulated with muriatic acid. A portion, neutralised by ammonia, was treated with sulphuretted hydrogen gas, but there was no change. In another portion acidulated gold-foil, with zinc, was suspended for twenty-four hours; at the end of which time the gold was as bright as when first immersed. This proved the absence of mercury. The yellow matter was in too small a quantity to be collected separately: it was probably some substance taken with the food, while the black colour of the mucous membrane was due to melanotic extravasation. The experiments then clearly negatived the presence of poison in the contents of the abdomen.—No portion of the matters vomited during life could be obtained for analysis.

This case is interesting; because it shows how easily symptoms and post-mortem appearances may be mistaken for those of poisoning, where they result from disease. The circumstances in favour of poisoning—leaving out those of a moral nature, which were somewhat strong—were:

1. The deceased having been taken suddenly ill, while in pretty good health.

2. The nature of the symptoms—severe pain in the abdomen, violent vomiting, and collapse.

3. Death in about fifteen hours after the first seizure, with but little abatement of the symptoms.

4. The appearance of inflammation, and other morbid changes about the stomach.

Against poisoning were the following circumstances:

1. The deceased's declaration that she had not taken poison, corroborated, as it was, by the non-discovery of any poison about her person or in the apartment.

2. The time of the occurrence of the symptoms.—The poison could not have been a mineral acid, alkali, or oxalic acid: for these operate instantaneously, or within a few minutes after they are

swallowed; and a vessel or some liquid is discovered near the person. The poison, if any, was not likely to have been arsenic, mercury, barytes, or lead; since these rarely have their symptoms protracted for three hours; and there was no reason to suppose that the deceased had swallowed any thing subsequently to her dinner.

3. The nature of the symptoms.—Irritants, although they produce violent pain and vomiting, are generally attended with diarrhœa. Here there was no diarrhœa; and pain and vomiting alone, coming on suddenly, are far from being conclusive evidence of poisoning.

4. The absence of poison from the stomach, duodenum, and contents of the abdomen.—This, although it does not absolutely negative the fact of poison having been taken, is, *cæteris paribus*, a strong presumption against poisoning, in a case where death was so rapid.

5. The nature of the post-mortem appearances—inflammatory redness, black striated extravasation, and perforation of the stomach. —Inflammatory redness is of little importance, where so slight as in the present case, unless there be other strong evidence to show that it was probably produced by poison. It is not unfrequently met with in the dead body, where there can be no suspicion of poisoning; and it was probably, in this case, a concomitant of other more active disease in the stomach. Black striated extravasation on the mucous membrane is certainly seen in poisoning by sulphuric or oxalic acid; and this stomach bore very much the appearances that I have observed in cases of poisoning by those substances. But there were these striking differences; in poisoning, the striæ are highly acid and soft, easily removed by scraping, and, on analysis, give evidence of the presence of the poison: in disease, there are none of these characters; and there were none in the present case. Besides the manner in which the deceased was seized, and the circumstances under which she was found, showed that neither of these bodies could have been taken by her.

Lastly, Perforation.—This as a consequence of poisoning and disease, has been already amply noticed. The aperture in the deceased's stomach had taken place during life; for there were all the marks of peritonitis. The appearance of the aperture did not resemble that produced by a corrosive, nor was there the least reason to suppose that it was produced by an irritant, poison: for, independently of the absence of ulceration or erosion about the aperture and intense vascularity in the stomach and duodenum, the facts of the case entirely removed the idea of its having been produced by an irritant. The deceased clearly died from peritonitis, produced by the effusion of the contents of the stomach through the perforation, whatever the perforation may have depended on: but peritonitis requires some hours for its establishment, and the deceased only lived fifteen hours after her first seizure. Admitting that it requires a period of at least twelve hours for peritonitis to be set up to the

degree in which it was here found, the irritant must have caused perforation through the parietes of the stomach in three hours; but this is in the highest degree improbable, and sufficient alone to induce us to seek some other cause for the perforation. This cause we shall at once find in the insidious disease, to the history of which so much of this paper has been devoted: namely, scirrhous ulceration, leading to perforation of the stomach. The correctness of this view will be perhaps at once apparent, when we consider, the age of the deceased—the slight preceding indisposition, indicating the disorder of the stomach—the suddenness of the seizure, and severity of the pain in the abdomen generally—the vomiting without diarrhœa—and death in fifteen hours under symptoms of peritonitis. The post-mortem examination bears out the inference from the symptoms; in the discovery of the marks of peritonitis, and of an aperture in the stomach, the situation, form, and characters of which were exactly those of disease. Hence then the conclusions to which Mr. Hilton and myself came respecting this case were: 1. That the deceased had died from peritonitis, caused by extravasation of the contents of the stomach. 2. That this extravasation arose from a perforation in the organ, caused by slow and insidious disease, and not by poison.

In consequence of this opinion, it was not deemed necessary that a coroner's inquest should be held on the body.

2. *A person labouring under the disease may be the subject of poison.*

This we must regard as a rare coincidence; but still likely to occasion some embarrassment when it occurs. There are two recent cases on record. The first question which may arise, will be whether the perforation, or the diseased state of the stomach leading to it, was due to poison; and, 2dly, whether the disease or the poison was the cause of death. The first question will be answered by considering the nature of the substance. Thus, knowing that corrosives and irritants alone are liable to cause perforation of the stomach, the discovery of a narcotic poison will show that the disease, and the substance taken, could not have had any connection with each other. So again, among irritants, there are some, perhaps the greater number, not likely to be followed by perforation of the stomach. The second question will be answered by attending to the symptoms under which the person dies, and the appearances found in the body. The discovery of poison, by chemical analysis, in the alimentary canal, avails but little in a case of this kind; because it is not disputed that poison has been taken:—the main question is whether or not it was the cause of the symptoms and death.

A woman swallowed, by mistake, half an ounce of powdered muriate of barytes, dissolved in warm water. Nausea, and vomiting, of a watery mucus, supervened, with twitchings of the facial muscles, and convulsive motions of the hands and feet. The

symptoms continued to increase in severity; and she died about two hours from the time of taking the poison, under the most violent convulsions. On inspection, the stomach was found perforated, posteriorly in the lesser curvature, near the cardiac orifice. The aperture was of an oval form, three lines in diameter externally, and almost twice as large internally. The margin appeared swollen, and the mucous membrane, for about two inches round, was much thickened, and covered with a bloody mucus. The stomach and small intestines were highly inflamed; the cavity of the former contained mucus and coagulated blood. The pharynx and œsophagus presented slight marks of inflammation. The poison was found in the stomach, by chemical analysis.

This case is, in many points of view, worthy of attention. Wildberg, who reports it, suggested that the perforation was due to previous disease, and not to the poison taken. This is, certainly, the more probable opinion; for the characters of the aperture are those of disease, somewhat modified by the irritant effects of the poison. Certainly, it is not likely that muriate of barytes, although an irritant, should have produced perforation of the stomach in two hours, if it were capable of producing it at all. It is not stated whether the woman suffered from any symptoms indicative of gastric irritation, prior to taking the poison; nor whether the contents of the stomach were found extravasated, and the peritoneum inflamed: hence a decision on the cause of perforation is uncertain, although it is in the highest degree probable that the poison did not occasion it. But, whatever may be the view adopted on this point, there can be no doubt that the woman died from the effects of the poison. This was clearly indicated by the nature of the symptoms and post-mortem appearances. Admitting that no mistake was made respecting the time at which the poison was taken, it must be considered as remarkable, that this irritant should have destroyed life, and left such extensive marks of irritation in the alimentary canal in the short space of two hours.

About two years ago, a woman was tried, on the Western Circuit, for poisoning her husband with arsenic. The deceased was attacked with severe pain in the abdomen, and vomiting, after having eaten his dinner, which was prepared for him by the prisoner. Medical assistance was called in; but he continued to become worse, and he died in about sixty hours after the first attack. It was shown, that arsenic had been probably given to him at the dinner; and also on several other occasions, when it was supposed to have been substituted for some medicine prescribed for him; since his symptoms were uniformly aggravated after each dose. The chemical evidence was very clear: arsenic was discovered in the vessel in which the dinner was dressed, also in the stomach of the deceased; and the poison was traced to the possession of the prisoner. On examining the body, a scirrhous ulcer was found in the stomach, near the pyloric orifice; which was evidently of long standing. It was about the size of a shilling, had a dark appearance, and the margin was

inflamed. The mucous membrane of the stomach, as well as the duodenum, was in such a high state of inflammation, as to resemble red velvet. The defence on the trial was, that the symptoms and death of the deceased were due to this scirrhous ulcer, and not to poisoning. It was shown that the deceased had suffered from a gnawing pain in the stomach for a very long period; and it was thought by himself, as well as by others who saw him, that this last attack of illness was nothing more than aggravation of his old complaint. The medical witness did not hesitate to refer the symptoms and death to arsenic, for the following reasons:—the symptoms occurred suddenly and violently, after a meal at which arsenic was proved to have been administered; some of them were peculiar to poisoning by arsenic, and totally unconnected with disease. Pain and vomiting might be ascribed to either cause; but the intense thirst, well-marked inflammation of the conjunctiva, coldness of the body, and, before death, paralysis of the extremities, with loss of sight, were unquestionably owing to the operation of arsenic, and not to the effect of chronic disease. This, besides, was not likely to destroy life with such rapidity, and under such severe symptoms.—The post-mortem appearances corroborated the opinion founded on the symptoms, and showed that death was really due to an active irritant poison. The woman was convicted and executed upon this evidence.—The manner in which this investigation was conducted reflects the highest credit on the medical witnesses.

3. *A person, labouring under the disease, may have received blows or injuries on the abdomen: in which case it may be necessary to state, whether the perforation did or did not result from violence used.*

It is evident, from the insidious nature of this disease of the stomach, that a person labouring under it may become the subject of violent treatment, and the fatal symptoms not show themselves until after the violence. I have met with only one case of this kind which is recorded by Mr. Watson.

A healthy stout boy, aged 11, was ill-treated by another boy; but it does not appear that he was struck on the abdomen. After the ill-treatment, he complained chiefly of the pain in his bowels and head—seemed in great pain and could not take food; notwithstanding which he went out in the afternoon. The same evening he was much worse, and vomited greatly. Some medicines were given to him, which he could not retain on his stomach. On the second day after the injury, there was a little coagulated blood in the vomited matters. He died on the fourth morning, suffering throughout from pain and vomiting; but his bowels were confined during the whole period. On inspection, there were no external marks of injury. Within the abdomen there was a considerable quantity of pus; and extensive agglutination of the intestines, which were much inflamed, by effused lymph. At the concave part of the stomach there was a perforation through its coats, about

the size of a sixpence; and near to this, two large spots of a purplish colour.—The other parts of the body presented a healthy appearance.—The medical witnesses referred death to inflammation of the bowels caused by violence. The perforation of the stomach was described as having a post-mortem origin, the result of erosion; they did not think it had been caused by ulceration. The prisoner was discharged by a verdict of "not proven."

The description of the aperture, imperfect as it is, seems to show that it must have been produced during life, and was not a perforation by solution. The deceased evidently died from peritonitis, caused by an effusion of the contents of the stomach into the abdomen; and there is no doubt, from the history of the case, that the perforation took place at or about the time of the violence; —but whether it was the result of this, or of insidious pre-existing disease, the effects of which were accelerated by the violence, it is not so easy to say, the characters of the aperture not being sufficiently detailed. The latter is, however, the more probable opinion; because violence, such as a blow on the stomach, even had this been proved to have been given, was not likely to have occasioned merely a round aperture no larger than a sixpence, in the concave part of the organ. Hence, although it is plain that the perforation led to death through peritonitis, it is doubtful on what cause the perforation exactly depended.

4. *Perforation of the stomach from post-mortem changes may be mistaken for perforation from poison.*

The only case in which this can possibly happen is, where, conjoined with the discovery of perforation after death, there may have existed symptoms of irritation in the alimentary canal during life, from accidental causes. It is quite possible that a person may die under symptoms somewhat resembling irritant poisoning, and after death, the gastric secretion destroy the parietes of the stomach; but such a singular combination of circumstances would be most unusual. That, however, signifies little in a legal point of view; for persons charged with crimes, are frequently acquitted on the barest medical possibilities. One case of this doubtful kind is on record; —I allude to that of Miss Burns, for the murder of whom, by poison, a Mr. Angus of Liverpool was tried about thirty years ago. It is not necessary to enter into the particulars of this case, since the reports of the post-mortem appearances are somewhat imperfect. Although the symptoms, resembling irritant poisoning, under which the deceased laboured, were not accounted for, yet there was strong reason to believe they were not connected with the perforation found in the stomach, which, on the whole, bore the characters assigned to that produced by the gastric secretion. The charge of poisoning was not sustained by chemical or pathological evidence, and the prisoner was acquitted. The evidence given on this trial is well worthy the attention of every medical practitioner. It shows on what a nice balance of proofs charges of poisoning sometimes

rest; and how important it is that we should make ourselves acquainted with all the circumstances under which perforations of the stomach may take place.

These are, I believe, the principal medico-legal questions connected with this subject. From all that has been said, it will be seen how little individual experience is fitted to serve as a basis for our opinions; since it is not possible, even in the widest field of observation, that every variety of case can occur to one individual. We are bound, in all medico-legal questions, to take the most enlarged view of the subject; and to supply what is deficient in our own experience, by that which has fallen within the observation of others. It is a full conviction of the necessity for this generalisation of facts and principles, to render them useful in medical jurisprudence, which must be my apology for having, in the course of this paper, drawn so largely on the experience of others.

ON INCISION

IN

CASES OF OCCLUSION,

AND

RIGIDITY OF THE UTERUS

BY SAMUEL ASHWELL, M. D.[1]

I am desirous to make a few brief and practical observations on the safety of incision, in most cases of entire closure of the os uteri; and in some, of the rare examples of its extreme rigidity at the time of labour. It is essential to be thus explicit in defining the cases where such an operation is required, to guard against a rash and unwarranted use of the knife; and it may unhesitatingly be affirmed, that the practitioner, before such a procedure is determined on, ought to be most fully convinced that the patient's safety can be better secured by this than by any other method. It may too be observed, that the medical attendant should not, except when a consultation cannot be obtained, adopt the plan now proposed on his own responsibility. When the operation is sanctioned by others, should the event be unfavourable—which will rarely happen if the incision be practised sufficiently early—not only will the operator's own feelings and reputation be spared, but the immediate relatives of the patient will entertain no doubt as to the propriety of the practice.

There is sufficient novelty about both the points under discussion, to justify the few remarks I am about to make: and if I shall succeed in throwing a little additional light on these perplexing cases, my purpose will be fully answered. Happily, entire closure, and such extreme rigidity of the os as to preclude the birth of a child if help be not afforded, without more or less extensive laceration, are rare. Still, two such examples—the one of closure, and the other of rigidity—where incision has been successfully practised, have fallen under my own observation within a short time. More may occur; and I shall therefore be excused if I occupy a few

[1] Guy's Hospital Reports, No. viii. Apl. 1839, p. 126.

pages of the Guy's Reports in bringing the history and the treatment of such instances of morbid structure before the profession.

It may, I think, be shown,

1st, That incision is the safest remedy, where the os is in a state of firm and complete closure; or, in other words, where the uterus, so far as its lower orifice is concerned, is imperforate: and,

2dly, That in examples of such extreme rigidity of the os, where, after hours of strong uterine effort, the power of dilatation is entirely absent, whether such rigidity arise from disease in the structural organisation of the part, or has resulted from previous laceration and ulceration, incision is the best and safest treatment; far preferable to protracted and powerful dilatation of the os by the finger; or, on the principle of non-interference, to leaving the case to the natural efforts.

Examples of the entire closure of the os uteri at the time of labour are recorded by Dr. Nægele, jun., in his Thesis on "Conglutination of the Os Uteri," published at Heidelberg in 1835. And there is by no means a paucity of allusion to them by other writers. I have, in a former paper, pointed to the cause of the simple agglutination or closure of the os. It is well known, that normally, this orifice is sometimes very small; at others, instead of a transverse chink—its most usual form—there is merely a diminutive circular aperture. In either of these conditions of the orifice, complete obliteration may easily be produced, by an amount of local inflammation following conception, which would not seriously interfere, either with the pregnancy or the health of the individual. It is important to bear in mind, that such closure may not be attended by any other disease of the parts: the adhesion may be firm and complete, but there may be no scirrhous induration—no distinct nodule of hard substance; the neck of the uterus will be forced down by the pains; and the sensation imparted to the finger, on examination, during labour will be quite natural; excepting only, that no aperture will be found. There is therefore a marked difference, so far, between the cases of closure occurring as the result of adhesive inflammation, where the orifice is, naturally, unusually small, and the instances of occlusion which are the consequence of previous morbid deposit about the os and cervix, produced either by chronic inflammation, or occurring as the result of former laceration or ulceration. In the latter class of cases, where there is evident organic disease of structure, a long delay in the employment of venesection—and of the incision, if the bleeding fail—is not probable; whereas in the cases of simple but firm closure, where there is no other disease, delay is far more probable. It will be urged as extremely unlikely that there should be no os uteri;—that there is one perhaps, but that, owing to obliquity, it is very high up posteriorly; and that, being thus unnaturally situated, twenty-four, thirty-six, or forty-eight hours, or even a longer period, will be required for its development and dilatation. The unfortunate instances of occlusion recorded by various authors may be attributed to this very delay; and they

show how necessary it is that every circumstance should be explained, and if possible removed, which may tend to mislead in a newly observed and hazardous malady. M. North, an experienced and able obstetric practitioner and lecturer, dwells at great length on malposition of the womb uterus; and does not hesitate to express his belief, that most of the reputed instances of imperforate uterus were really nothing more than cases of anterior obliquity; and the names of Baudelocque, Desormeaux, Velpeau, Denman, and Dewees, are adduced as holding these opinions. For myself, I may say, that I have never met with any seriously protracted labours from obliquity; and I think I could mention many highly respectable writers, whose experience corresponds with my own in this particular. Allowing, however, to this supposition of Mr. North its full weight, it must be recollected, that every hour of urgent uterine effort tends to rectify obliquity, if such be the cause of an undiscovered os uteri; and that if the pains are really powerful, and protracted for ten or twelve hours, the os uteri being still undiscovered and undiscoverable, it may fairly be assumed that it is wanting, and it is time then to think of the dangers of uterine rupture and laceration. So far as the case and its continuation, so correctly reported by Mr. Tweedie,[1] can illustrate this point, it may be cited as an example of the facility of diagnosis, and of the safety of the treatment by incision. The error of the first operation, performed by myself, consisted in its delay. From anxiety not to incise the uterus if it could be avoided, the woman was permitted to incur more risk than was justifiable; and from the excitement and fatigue of the labour, the collapse was alarmingly dangerous—much more so than after the second operation, when, confirmed in a favourable view of incision by its previous success, the division of the parts was earlier resorted to by Mr. Tweedie, and the collapse was proportionably slight and transient.

There can be but little difficulty in the diagnosis of instances of complete and firm closure of the os. When parturient effort is really established, the lower portion of the uterus, in the form of a tense and large globular mass, is generally forced down very low, sometimes so far as nearly to reach the external entrance of the vagina. Thus a finger—at all practised in these enquiries—*must* detect an aperture, if there be one; and, if not, the spot where the os uteri, at the time of conception, had been.

A repetition of uterine action will afford abundant opportunities for careful re-examination, so that no apology for indiscreet and dangerous delay can exist. If, too, a spot shall be discovered—more depressed, and of different structure to the surrounding parts, indicating the site of the os uteri at the time of impregnation, it is impossible then to doubt about the nature of the case; and the only question remaining to be determined, is the precise method of relief.

It may be a matter of hesitation, whether bleeding to some

[1] See Vol. II. p. 258.

extent—say, eighteen, twenty-five, or thirty ounces—should not precede the use of the bistoury.

In some critical remarks on Mrs. Pursell's case, in the "British and Foreign Medical Review," Vol. III. p. 375, the writer says: "Under the circumstances, we believe the incision (made by Dr. Ashwell) into the cervix was justifiable; though we think it not impossible, *that, had a free venesection been premised, and some further time given*, an os uteri might have been found." From which opinion I entirely dissent.

Practitioners should be extremely cautious on both the points now alluded to—I mean bleeding and delay. It would be difficult to justify a large venesection in cases of closed os, like those now described, where there was no other disease about the parts than the occlusion: if there were malignant deposit, a general scirrhous induration of the cervix, or cicatrices of cartilaginous hardness, the abstraction of blood in a case thus complicated would be highly judicious: and certainly, if there be so much doubt resting on any case, as to leave it a matter of question, whether there be an os uteri or not, venesection and delay are less censurable, than the continuance of the doubt and uncertainty. If, however, the practitioner has decided that there is an occluded os, without other disease, and that the head of the child cannot pass, till a way be made for its transit, little else than exhaustion, and danger, are to be anticipated from bleeding and delay.

I purposely avoid, in this part of the paper, more than allusion to those cases of occlusion of the os uteri complicated with marked and decidedly morbid altered structure. These examples are so closely connected with the cases of extreme rigidity, and so generally arise from the same causes—viz. organic disease, and the injuries or lacerations of previous labours—that it is quite proper to place them in the same part of the Essay.

Having abandoned all hope of discovering an os uteri by venesection and delay, there are two methods of remedying the closure of this important orifice:—

1. By such an amount of pressure, by the finger, female catheter, sound, or bougie, as shall puncture or open the occlusion; and,

2. By incision, made by a bistoury or knife.

Dr. Nægele, jun., of Heidelberg, advocates the first of these plans; and condemns the use of the knife, except as a last resource, the other means having failed. My friend Dr. Waller has, in the present number of the Reports, furnished a case so treated.

When the occlusion is slight, depending on a thin membrane, interposed between the margins or filling up the circumference of the os, similar to the membrane found between the adherent labia of female children, the finger, as recommended by Nægele, in his very interesting Thesis, may produce a separation or orifice; or, if this digital pressure be insufficient, the catheter, sound, or bougie, may enable us to do what we wish. It is afterwards to be expected, if the structure of the cervix be healthy, that dilatation of the os will

proceed as satisfactorily as in the many cases where this orifice is naturally small. In such, we rarely find the power of dilatation absent.

Nægele proves, that, in such examples of conglutination, the finger will succeed remarkably well. His reasons for preferring the digital puncture to the knife, are given in the following quotation from his Essay:—

"Conglutinationis orificii uteri sanatio in quam plurimis casibus nullis obnoxia est difficultatibus. Aut digito aut instrumento satis obtuso, e. g. cathetere femineo, digito duce in vaginam immisso et orificio uteri leniter adpresso conglutinatio, sine ulla parturientis molestia, facile disrumpitur; plerumque nonnullæ sanguinis guttulæ inter operationem effluunt, testes materiam organicam operatione ruptam esse."

"Digitum autem ad operationem perficiendam instrumento præferendum esse censeo, tum quia ad destruendam conglutinationem plane sufficit, tum quia digito adhibito minus timendum est, ne ovi membranæ lædantur; tum quia si digitus non sufficit, ab instrumento obtuso auxilium vix exspectandum erit.

"Hanc autem medendi rationem operationi per incisionem præferendam esse, nemo certe in dubium vocabit; quanquam enim incisio a manu perita et caute instituta non omnino periculosa est, cum experientia uterum satis graves læsiones sine infelici successu tolerare doceat; negari tamen nequit, incisione ab homine in arte chirurgica minus perito facta, utique deploranda parturienti inde evenire posse mala. Nonne enim, e. g. bulla aquarum incisione læsa, dolorum vi subito jam aucta, caput fœtus fortiter descendens ipso instrumento vulnerari potest?"

But Nægele's method of procedure is clearly inapplicable, where the interposed cellular membrane, shutting up the os, has become thoroughly organised and firm; so much so, indeed, as effectually to have resisted twelve, twenty, or thirty hours of most urgent uterine effort: although I am quite aware, that neither the wedge like dilating property of the membranous pouch containing the liquor amnii, nor the head of the child, supposing it to present, can be brought, owing to the occlusion, fairly to bear upon the closed os.

Nor must it be foregotten, if the finger or catheter be forcibly used to make an artificial os, that the parts would be contused, and that there would probably ensue, after such contusion, local, if not general uterine inflammation. If this be the result, the chances of recovery are greatly diminished.

It may too, perhaps, be fairly assumed, that the risk of unlimited laceration of the uterus and adjacent parts is much less, where incisions of tolerable extent have been discreetly made, than where merely a diminutive central aperture has been formed by a blunt instrument. In Mrs. Purcell's case, after both operations—and in others, where incision was practised—the subsequent lacerations were confined to the cervix; they were restrained within the limits

of the reflection of the mucous membrane over the neck, and did not involve the peritoneum, the body, or fundus of the womb. As of additional weight in Mrs. Purcell's case, it may be stated, that the structure into which the incision was made, was not the structure of the cervix; for it was clearly ascertained, afterwards, that a cervix did not exist; and yet, although, in both instances, the incisions by the knife were followed by rent, yet in neither did those lacerations extend beyond the lower segment of the uterus, included within the reflection of the vaginal mucous membrane.

I proceed now to the second part of my subject;—in treating of which, I shall attempt to prove, from the similarity of cases of excessively rigid and undilatable os uteri to those of occlusion, as well as from the experience of the operation itself, that, in many such cases, incision may be safely and advantageously practised. It will not be supposed that I recommend the knife to be at once employed in these more complicated maladies; but I am confident—so far, at least, as it is possible to be confident, in cases where a high probability must be our only guide—that where fatal results have occurred, they might often have been prevented by timely incision of the parts. But it has too often happened, as the appended cases show, either that the operation has been performed too late, or that a too powerful dilatation by the finger, and an unwise reliance on the natural efforts, have altogether superseded its employment. Examples of entire occlusion without disease, like those to which I have already alluded, are much more rare than extreme rigidity of the cervix and a diminished os: nor will it be found quite so easy in the latter, as in the former class of cases, to determine the precise moment when bleeding, diaphoretics, fomentation, and delay, are to yield to the use of the bistoury; still the general safety of incision, and the known and imminent danger of protracted and severe uterine effort and contusion, ought to induce an *earlier*, rather than a *deferred* operation. A careful perusal of the cases and authorities appended to this Essay, especially Smellie's, can scarcely fail to impress this conviction. In every instance, or nearly so, where the division of the morbid structure has been made, prior to the occurrence of inflammation and sinking, it has succeeded; and, generally, with the fewest possible bad symptoms. Where, on the contrary, violent uterine action, contrary to the sagacious directions of the experienced Dr. Hamilton, has been allowed to go on for a great number of hours—say, twelve, fifteen, twenty-four, or even a longer period—the result has been generally unfavourable, often fatal; and still more certainly so, where, during a portion of this time, powerful dilatation has been long and forcibly employed. Dilatation by the fingers is not the same operation here, as to its safety, which it is found to be in examples of rigidity not dependent on, or associated with, local or structural malady. It is true, that, in transverse and placental presentations, artificial dilatation is often practised with safety and advantage. Neither the mouth nor neck of the womb, both being healthy, suffer from the process: prevention

of hemorrhage, and a freedom from useless and exhausting pain, are the results of the process: but where the cervix is rigid, contracted, and diseased, and the os so small as scarcely to be recognised, powerful and long-continued artificial dilatation *must be a dangerous remedy.* It is scarcely to be expected that it should relax the parts and lead to dilatation: it is much more likely that it should irritate, and thus induce inflammation, gangrene, and death. I have said, that cases of entire occlusion and excessive rigidity have points of resemblance: but it must also be acknowledged, that they present important and marked differences.

The simplest, perhaps, of the examples of rigid os uteri is where a very contracted orifice is surrounded by a structure almost entirely undilatable. In such a case, although there may be little if any indication of organic change, still, if there be a total absence of the power of dilatation, after the use of free venesection and antimony—time having been allowed for their beneficial effects—such a case cannot be long trusted with safety, either to the natural efforts or artificial dilatation. Other examples are not so simple as this. Many, probably the majority, are the consequence of some previous morbid occurrence. The os and cervix may have been injured in a former labour: abscesses, ulcerated surfaces, and cicatrisations, may have taken place: thus the uterine orifice may have become nearly, if not entirely closed; and the relative situation of the urethra, bladder, and vagina, so altered, as to render the division of parts much more difficult and hazardous: or it may be, that a hard tumour, or a more malignant and active deposit, has imbedded itself in these parts, totally altering the os and the natural structure of the cervix. In one essential particular, all these varieties will be found to agree; viz. in the difficulty with which the os and cervix are dilated; while in some, and not a few of them, the susceptibility of dilatation will have been entirely destroyed.

Supposing, then, that the incapability of dilatation is satisfactorily established—what is to be done? We are presuming that the disease is well understood pathologically;—that bleeding and every adjuvant remedy have been fairly tried, but without success.

The case may then be treated by *artificial dilatation, or by incison; or it may be left to nature.* To adopt the last course, would be to consign the woman, most probably, to unlimited laceration, if the womb continued to act; or to death, without laceration, if, worn out by protracted yet fruitless uterine pain, inflammation should be set up.

Of artificial dilatation enough, perhaps, has been already said, to indicate how little confidence in such rigidities can be placed in the utility of a moderate stretching of the uterine orifice: and certainly no impression can be derived from the appended cases favourable to protracted and powerful dilatation by the fingers or hand.

It may then be assumed, that we are not justified in protracting the employment of the knife till the patient is well nigh exhausted by the continuance and severity of the expulsatory efforts; the

dications of approaching collapse being apparent, in a quick and feeble pulse, a cooling surface, hurried and short respiration, a subdued tone of voice, a tender and tympanitic abdomen, and a gradually diminishing uterine pain. Many instances are on record precisely of this kind; and the event, in nearly all, was fatal. Nor ought we to hesitate about incising the cervix, where the violence and frequent return of the uterine effort threatens rupture of the womb. If there be distressing and constant pain about the neck or body of the uterus, or in any other part; if the countenance becomes turgid and dark; if perspiration issues at every pore, and the pulse is full, strong, quick, and incompressible: and if these symptoms continue, although perhaps somewhat lessened by bleeding and antimony; there can be no doubt that recourse should be had to the incision. It is impossible to fix a precise limit during which a patient may be safely left to her own unaided efforts; time cannot be the sole ingredient, although an essential part of every rule, regulating interference in obstetric cases.

There can be no doubt, that, in many instances of rigidity, a free abstraction of blood, the exhibition of $\frac{1}{6}$th, $\frac{1}{4}$th, or $\frac{1}{2}$ gr., every hour, of tartarised antimony, with or without opium, till it produce nausea, will accomplish the dilatation. No sensible practitioner would feel himself warranted at once to propose incision; nor would such an individual consider himself justified in not performing it when other means had failed. While, on the one hand, I am anxious to avoid the imputation of rashness, I am, on the other, if possible, more desirous to avoid the imputation of timidly shrinking from a procedure absolutely essential to a patient's welfare.

The operation, in any of the cases, whether it be on an os firmly closed, yet without organic change—or on an os very diminutive and contracted, with or without surrounding disease, but entirely undilatable—is, generally, easily performed. A probe-pointed knife or bistoury is the instrument most safely used;—the woman lying, either on her left side or on her back, close to the edge of the bed. The fore-finger of the left hand is to be carried to that spot of the cervix intended to be cut: afterwards, the knife or bistoury is to be cautiously conveyed, along the finger in the vagina, to the spot already mentioned; and if its point be gently pushed against the uterine structure, it will completely incise the parietes. In Mrs. Purcell's case, I carried the knife, first of all, forwards, toward the neck of the bladder, (which was empty,) carefully avoiding it; afterwards towards the sacrum, making an incision about two inches long. The liquor amnii will necessarily escape as soon as the first incision is made. The instrument may now be carefully withdrawn, and the further dilatation left to nature. It is scarcely to be expected that all rending should be avoided; but the extent of the tearing is, as has been already stated, generally confined within the limits of the vagina. I have no experience of the better effect of a crucial incision, in preventing extensive laceration; but I am favourably inclined to it. It is not probable that much blood will

be lost during or after the operation: in my own cases, only a few drams escaped. If there should be fainting and collapse, after the incision of the parts, brandy and ammonia may be freely exhibited. It is a necessary preliminary step that the bladder and rectum be emptied of their contents. In Mrs. Purcell's case, the birth of the child was accomplished, in both instances, without instrumental aid; but the forceps is not unfrequently necessary safely to terminate the labour.

The remaining part of the paper will be occupied by a brief summary of the most important circumstances of some of the various recorded examples of occluson and rigidity, in which incision was or ought to have been practised.

CASES OF ENTIRE OCCLUSION.

Case 1.—Mrs. Purcell's (see Guy's Hospital Reports, Vol. II. p. 258.) Here the patient, prior to the incision of the neck of the uterus, had been in strong labour for twenty-nine or thirty hours.

The division was made by a sharp-pointed bistoury (Dr. Ashwell not having a blunt-pointed instrument at hand.) There was scarcely any pain complained of; and not more than a few drams of blood were lost. Although there were two or three lacerations after the incision, and rather alarming collapse, the natural efforts were sufficient for the delivery; and the patient recovered quickly and well. The child, although somewhat asphyxiated at birth, rallied.—Length of incision, about two inches.—In this case, it was satisfactorily ascertained that there was no cervix; and the left mamma had no nipple.

Cases. 2 and 3—are examples taken from the Thesis of Dr. Nægele, jun., page 19 (published 1835.)

In both, the os uteri was, normally, exceedingly small; and the occlusion was produced by cellular membrane filling up the orifices. The lower part of the uterus was rendered very tense and hard, and greatly pushed down by the uterine efforts; so that, in one of the cases, it might with some excuse have been mistaken for the bag or membranes containing the liquor amnii.—In Case 2, the patient was fat and plethoric; and so violent were the pains, that, although she had been bled four times, no pain occurred without hemorrhage from the mouth and nose. It appears that she was more or less in labour for eight days (matrona quædam plethorica et satis obesa per *octo dies* vehementissimis ad partum doloribus agitabatur, ita ut sanguis ei e naribus et ore erumperet, quanquam jam quarta vice ei vena secata erat.)—In Case 3, the patient had been in labour two days and nights. A female catheter was used in both these cases, to accomplish the puncture. In both, the uterine orifice dilated (confirming the opinion I have expressed in another part of the paper,) not only without laceration, but with

only a moderate amount of delay. The forceps was not required in either; and in both, the children were born alive and healthy.

These are instances, not of very firm and organised closure of the os, but of conglutination effected by a slight cellular membrane —"ope telæ filamentosæ"; the finger or the catheter, would therefore do remarkably well.

Case 4. (also taken from Dr Nægele's Thesis, p. 27.)

On the 17th of August 1822, Dr. Meissner, of Leipsic, was called to a patient, thirty-five years of age, in her second labour. The pains were first felt on the 14th of August, and they had increased on the succeeding day. The midwife, on examination, detected the head of the child, but could not discover an os uteri. A surgeon was then called; and although he urged the patient to bear down when the pains occurred, by which the lower segment of the uterus was pushed very low in the vagina, still he could not discover any uterine orifice.

At noon, on the 16th of August, the woman was so exhausted, that she was unable to make any further voluntary efforts, although she still complained of the urgency of the pains. In the evening, the pains were less frequent and strong; and during the night she was delirious. In this state Dr. Meissner first saw her, on the morning of the 17th of August. The pulse was small, quick, and intermittent; and the patient was exhausted and worn out. The head of the child was entirely covered by the inferior portion of the uterus, much stretched and attenuated; and although the globular mass was pushed almost to the lower orifice of the vagina, there was to be found no vestige of an os uteri. Dr. Meissner, convinced that the uterine orifice was occluded, determined on the propriety of making an artificial opening. He did this with a scalpel; and, by the forceps, brought into the world a dead child. At nine o'clock in the evening the patient died.

It is scarcely possible that any case should more entirely verify the opinions advanced in the former part of this essay. The occlusion here seems to have been as firm as in Mrs. Purcell's case: and we must deeply regret that the operation was not performed at the expiration of twenty-four hours, instead of at the end of nearly three days.

Cases 5 and 6 (also from Nægele, p. 28) are examples of occlusion of the os uteri produced by membranes filling up the orifice, and uniting the margins of the aperture. In one, the pressure of the finger was sufficient to rupture the membrane. In the second, the point of the female catheter was used. In both, parturition was accomplished without instruments. The children were living at the time of birth, and both the mothers did well.

Case 7 (also from Nægele, p. 32) was managed by Dr. Rummel.— The labour commenced on the 25th of August 1822. The patient was pregnant for the first time, and had suffered from leucorrhœa during the whole period.

There was no os uteri; and on the 27th of August, Dr. Rummel

made one, by incision. Six hours afterwards, he applied the forceps, and brought into the world a living child. The patient recovered well. The orifice retained afterwards the form it had received from the incision; and in the next confinement there was no necessity for further interference.

Case 8 (also from Nægele, p. 34.)—Here the patient was forty-two years old, and in her first pregnancy. The labour commenced May 2; and Dr. Solera, after repeated examination, was unable to find an os. On the 4th, in the presence of other medical men, an incision was made into the neck of the womb; and twenty-two hours afterwards the child was brought away by the forceps.

Case 9—An example of complete occlusion at the time of labour, the patient having previously borne several children. Dr. Waller, of Bartholomew Close, furnished the case to Mr. Tweedie; and for a full account of it, see the present number of Guy's Hospital Reports.

Case 18, is reported in Dr. Gooch's published lectures.—After miscarriage, extensive sloughing took place, comprehending the os uteri; in place of which there was only a hard contracted circle, as if formed by a cicatrix. This woman was attended in her labour by three surgeons; all of whom agreed in the fact, that the os uteri was lost. The labour-pains were not sufficient to force the head through this unyielding portion of the passage: the head had descended low into the pelvis, pushing the lower part of the uterus before it. After waiting a considerable time, and the strength of the patient being almost exhausted, it was determined by the professional attendants, to cut an os uteri. The patient was taken out of bed, and placed in the position for lithotomy; so that the light fell on the vulva. By dilating as much as possible the external orifice, the cervical portion of the uterus was apparent, as well as the cicatrix in the situation of the os uteri. This part was first punctured with a sharp-pointed bistoury; and an incision of considerable extent was then made, with Pott's bistoury. The patient was replaced in bed: the labour pains returned; and the head was forced through the opening, rending it right and left. Some alarming symptoms now occurred; and as the head descended slowly, it was perforated, and she was speedily delivered. In forty-eight hours after her delivery, this woman had no bad symptoms. There was a purulent discharge from the vagina for about a fortnight; after which, she recovered perfectly, and is now pregnant again.

Dr. Gooch adds:—"Many similar cases, which were treated in the same manner, have been recorded: some of them terminated successfully; and others fatally, in consequence of the operation having been too long delayed."

It would be superfluous to add more such cases as these. They abundantly verify the opinions advocated, and the treatment recommended in this essay: and any one may easily increase his information on this interesting subject, by a careful examination of the authorities which support these views.

CASES OF CONTRACTED OS UTERI,

Co-existing with extreme Rigidity of the Cervix, demanding Incision.

Case 1.—A continuation of Mrs. Purcell's;—the complete history being given in the present number of the reports by Mr. Tweedie. Incision was practised: there was some rending of parts, and collapse. The mother and child both did perfectly well.

Case 2.—The following history demonstrates the inexpediency of strong artificial dilatation and delay. There can be scarcely any doubt but that recovery would have followed an early incision. It is however very instructive.

To-day, August 6, 1831, I visited Mrs. R——, residing in Spitalfields. She is thirty-one years of age; has been confined only two days; and is dying from peritoneal inflammation. I ordered ammonia and wine, together with a mustard poultice over the hypogastric region. The slightest pressure on the abdomen produced exquisite pain, pulse 148: weak, fluttering, and intermittent. Two days afterwards I inspected the body; Mrs. R—— having died shortly after my visit.

I was informed by the medical attendant, that the os was extremely rigid; and that having waited nearly twenty-six hours for its dilatation, he had stretched it artificially, by the finger; and although he had done it gently, she complained severely of pain, both at the time and afterwards. The atttempt at dilatation occupied upwards of two hours.

An examination after death showed the peritoneum to be generally inflamed, but especially the portion of it investing the uterus: there was a considerable quantity of dark-looking serum, tinged with streaks of blood, in the pelvic cavity; and floating in this serum there were many shreds and patches of coagulable lymph. On dividing the uterus from the fundus, downwards, the whole of the cervix, and much of the lower portion of the general cavity of the uterus, was found to be in a gangrenous state. The upper part of the vagina was inflamed and also gangrenous.

Case 3.—Vide "Smellie's Cases," Vol. III. p. 43.—As this case is very long, although interesting, I must refer the reader to the work in which it is contained, giving only the leading particulars.

It was under the care of Dr. Simpson, Professor of Medicine in the University of St. Andrew's.

The patient was observably narrow between the ossa pubis and the os sacrum; and the growing together of the sides of the os uteri, leaving no vestige of a passage, was the result of mischief occurring in a former labour, which lasted four days, and was eventually completed by the perforator. A plentiful suppuration from the internal parts continued for a time after the first labour.

Dr. Haddow confirmed Dr. Simpson's opinion of the case. Two days having now elapsed, it was determined to cut an os uteri; but

it was thought necessary, in order that the incision might be more securely made, that the vagina should be first dilated. This being completed, the cicatrix of the united parts was distinctly seen; and it was divided by an incision, at least half an inch deep. The child's head was then touched; and the whole circumference of the passage was found to be hard, like a cartilage, not at all yielding to several throes she had after the incision;—"so that I was obliged," says Dr. Simpson, "to guide a narrow bladed scalpel with my finger, and to make several incisions into this cartilaginous ring. The labour continuing, the passage dilated a little, but not so much as to give any hopes of its allowing the child's head to pass, notwithstanding the bones of the cranium were overlapped; and therefore I was obliged to bring away the child by perforation."

"My patient," says Dr. Simpson, "immediately after being put to bed, was seized with a pleuritic pain, very high fever, and difficult breathing: which coming on so soon after her being fatigued several days with hard labour—during which she slept none, but drank much—appeared to me rather the cause of her death in twenty-four hours after, than any consequence of the incision I had made; for she never complained of uneasiness in those parts, nor had she any hemorrhage."

There can be little doubt, that the contusion of the parts, and the collapse of the system consequent on the two days of hard labour, prior to the incision, induced the fatal result. Nor does it appear that bleeding, so likely to have been highly beneficial, was practised; at least, there is no allusion to it in the narrative of the case.

Case 4. (also from "Smellie's Cases," Vol. III. p. 205.)

This is a painfully instructive history. First of all, repeated and powerful attempts were made to dilate the os, not alone by Dr. Smellie, but by others also. Instruments were passed into the mouth of the child, with the same intention; and although considerable efforts were thus made, the dilatation could not be accomplished. Flooding and faintness were the consequence of these measures. "But," says Dr. Smellie, "after she was recruited, I tried again to dilate the os uteri; having found, in other cases, that it dilated easily when the patients were faint and weak;—but I found the same difficulty as before.

"I was apprehensive," says Dr. Smellie, "of using any greater force by pushing up lest I should tear the uterus from the vagina: but finding that I could not fix the crotchet to advantage, I again withdrew it. All this time the os uteri felt as if it was two inches thick.—Mr. Burnet, who had first seen the case, again attempted to dilate, even after this period, but without any success.

She died soon afterwards, in a convulsion, undelivered. Here, again, it does not appear that bleeding was practised. The case requires no comment;—venesection, and the incision, would probably have saved the patient.

Case 5.—Vide "Smellie's Cases," Vol. III. p. 211.

This is another instance of the same unfortunate kind; although here Smellie approached to the right treatment. The os uteri was open to about the size of half a crown, but rigid and very thin: it was a first labour, and that occurred two months before the full time.

After continued and unsuccessful efforts to dilate the rigid orifice, Smellie incised the neck of the womb by a pair of scissors: the parts afterwards gave way: the hand was introduced; and a dead child was brought away, by turning.

There was much flooding; and the patient died the fourth day.

Case 6.—From Dr. Nægele's Thesis, p. 17.

Here the patient was a healthy country woman, of 35 years of age. On examination, a very small aperture or orifice was found, from which there issued a brown mucous fluid. Various attempts were made at dilatation and delivery, but without success; and after two days of useless and protracted uterine suffering, the patient died. After death, there was discovered a very large rupture of the uterus.

I might increase the number of these cases; but I decline to do so: nor am I willing to increase the length of the paper by an addition of examples where timely and discreet incisions have been successfully practised. This treatment has received the sanction of some of the best obstetric writers and practitioners; and, I am persuaded, renewed trials will only confirm the value and safety of the procedure.

As references to some of these examples of successful incision in rigidity may be useful, I append them.—In the volume of the Medical Gazette for 1837, p. 585, I have detailed an instance where, in two succeeding labours, it was necessary to incise the os. Crucial incisions were made in both operations. In the first, perforation was resorted to. In the second, the forceps only was employed; but the child died. This patient has subsequently borne three living children: no further division of the uterus having been required.

In Professor Davies's work on operative midwifery, some valuable observations on rigidity will be found. He is fully aware of the unquestionable value of bleeding, as a remedy for, or corrective of, an actually existing rigidity: nor does he deprecate artificial dilatation, in some cases, if employed with tenderness and caution.

Several very interesting cases are recorded of the success attendant on timely incision; and one is quoted from Tretzelio, where fatal rupture of the uterus occurred, from non-dilatation of its orifice; in which, although severe labour lasted for nearly three days, no attempt of an efficient or decisive character was made to avert the calamnity. In another example, the patient was forty years old, and pregnant with her first child: she had been in strong labour for three days, and suffered convulsions during the second. Her person could not be known, she was so frightfully pale: her

pulse was weak, and almost extinct, as well as her voice, yet the ridge of the orifice of the uterus, open to the diameter of a crown piece, was hard, tight, and, in a manner, callous. Delivery was performed spontaneously in three or four minutes after the section of the part: the child was dead: but the mother immediately grew calm, and the subsequent symptoms were mild.

Heath's translation of Baudelocque, Campbell's Midwifery, and various other journals, may be consulted for further information.

Dr. Davies very properly refers to the forceps and turning, as important remedies, where the incision may have been unfortunately succeeded by a profuse hemorrhage, or having been too long delayed by an inability on the part of the uterus to effect its own delivery. If the head has advanced far into the cavity of the pelvis, the forceps must be resorted to: if, on the contrary, it be still at or above the pelvic brim, the hand, being of softer texture, and itself endowed with feeling, would be the more gentle instrument.

My friend Mr. Godfrey, formerly a student of Guy's, informs me, that recently, in Paris, M. Paul Dubois incised successfully in a case of occlusion of the os, after the employment of opium.

OBSERVATIONS

ON

FIBRINOUS CONCRETIONS IN THE HEART.

BY H. M. HUGHES, M. D., F. L. S.[1]

The notice attracted, and the interest excited, by the bodies which form the subject of the succeeding observations, appear to me to have varied according to the current opinion of the time, respecting changes in the blood as the cause of disease. While humoralism prevailed, they were, after their nature was understood, elevated to a rank of importance which at the present time appears ridiculous. The wonderful cases related by some old authors, in which snakes, worms, &c. were found in the heart and large vessels, without doubt, owed whatever they possessed of the marvellous to the presence of these concretions. According to Morgagni, they were first observed, or rather first regarded, as masses of coagulated fibrin in the early part of the sixteenth century; and continued to attract attention during the seventeenth and the beginning of the eighteenth century. If indeed, at this period, a firm concretion was found in the heart, it was often considered as sufficient to account for death; and further examination was deemed unnecessary. They thus probably for a time formed a serious obstacle to the progress of morbid anatomy, and, it is stated, were sometimes the cause of the escape of criminals guilty of the murder of the persons in whom they were found. These extravagant opinions were successfully opposed by Pasta and Morgagni, who employed arguments very similar to those now urged by physiologists who still entertain doubts of their formation prior to death. Since obvious structural lesions have been found, by the investigations of morbid anatomists, very generally to accompany disease, and have been commonly considered its cause rather than its consequence—or, in other words since solidism has reigned almost exclusively—these concretions have been usually looked upon as cadaveric formations. In consequence, however, of the more frequent examination of the fluids in disease, and the increased means for such examination afforded

[1] Guy's Hospital Reports, No. viii. April, 1839, p. 146.

by the advances of animal chemistry, the blood and its secretions have been proved to undergo considerable changes in the progress of many complaints; and it is not improbable that we may revert and are now slowly reverting, to a modified humoral pathology. In some degree, perhaps, in consequence of this commencing change of theory, several practical authors have, during the present century, deemed these bodies worthy of a brief notice; and Corvisart, Laennec, Andral, Kreysig, Testa, Hope, Legroux, Bouillaud, &c. have stated that they sometimes present characters which cannot possibly be regarded as cadaveric. Though I have noticed the objections of a modern author, the object of the following remarks is not to prove that these bodies are sometimes formed before death, but to describe them as they have been presented to my own observation. Their prior formation I have assumed; as, though the fact may be incapable of direct proof, and though the mode of their formation may be difficult of explanation, I am perfectly convinced that the appearances they exhibit, and the circumstances which attend them, are frequently such as are utterly inexplicable, independently of the continuance of life and motion, and are entirely distinct from any presented by, or accompanying fibrin, after its removal from the body.

That coagulation of the blood may occur in the vessels of the living body, is a fact clearly proved by the results of disease, and by experiments on the lower animals. That this coagulation generally depends upon one of two causes—viz. inflammation or other disease of the vessels themselves, or considerable retardation of the motion of the blood—will also, I presume, be generally admitted. Examples of both are familiar to the surgeon and the pathologist. Phlebitis and senile gangrene at once present themselves as apt illustrations of the one; and the clots found in varicose veins, the vessels of a stump, and arteries around which ligatures have been passed, may be advanced as instances of the other cause of coagulation; while the coagula found in aneurismal sacs, in veins passing through or near inflamed or malignant tumours, and in the vessels crossing phthisical cavities, may be perhaps dependent upon both causes combined. To these may be added the admixture with the blood of certain acrid or poisonous substances: though I think it doubtful if they are ever of sufficient power, or in sufficient quantity, to produce this effect, unless they have been designedly introduced, for the purpose of experiment.

By inflammation, the smooth polish of the lining membrane of the vessels is destroyed; and a layer of adhesive matter is effused, which favours coagulation of the blood, both by retarding its progress, and by separating it from the organised parietes, upon the vital influence of which its fluidity in some degree depends. A clot is formed, which becomes adherent, and is afterwards absorbed, or organised by union with the inflammatory product of the vessel.

Rest, perfect rest, is not necessary to coagulation of the blood,

either in the vessels, or when removed from the body. For it is, I conceive, impossible to suppose that perfect rest can exist in the fluid contents of an aneurismal sac, when coagulation first occurs, or when each successive fibrinous layer is deposited. The passage of the blood into the sac, and the alternate contraction and dilatation at each stroke of the ventricle, must, I think, cause the particles in some degree to move upon each other. The same may be safely asserted with regard to coagulation occurring in an ossified or tied artery, and the vessels of a stump; some motion must exist, some circulation must be carried on by means of small anastomosing branches, at the period when the process of coagulation commences. Indeed, I believe it is now generally acknowledged, that comparative rest, or a considerable retardation of the onward current of the blood, is sufficient to induce coagulation; and that upon this circumstance the operation for aneurism, particularly when performed on the distal side, is dependent for success. The fact is further proved by spiculæ of bone, when projecting into the cavity of arteries having appended to them (as noticed by Dr. Carswell[1]) pediculated masses of fibrin; and by coagula forming around meshes of fine thread introduced into and allowed to remain within them. A needle armed with several fine threads, was passed obliquely through the axillary artery of a dog; and the threads pulled till the extremity dropped into the cavity of the vessel, in the blood in which it was left floating. The next day the circulation through it had ceased; and on the third day the animal was killed. That portion of the vessel submitted to the experiment was externally red, swollen, and firm; and contained a fusiform coagulum, an inch and a half in length; though the lining membrane of the artery was not inflamed, and there was not the slightest trace of plastic or other effusion.[2]

Now, reasoning from analogy, we might, *à priori*, expect, that what occurs in two portions of the circulating system, the arteries and veins, would under similar circumstances, likewise occur in the third portion, the heart; and we might therefore be induced to believe, that fibrinous concretions, or, as they are usually called, polypi, when formed before death, depend upon the same causes as those giving rise to coagulation in the vessels. This opinion is, I think, entirely confirmed by observation. But as in some cases of retarded circulation, this coagulation does, and in others, in which the obstruction is equally great and the general debility is equally decided, it does not occur—and as, in some cases of diseased heart, in which the delay of the blood is as great as, or probably even greater than in those in which fibrinous concretions are found, such formations are not discovered after death—it may be fairly presumed that a peculiar condition of the circulating fluid considerably favours the process, though that condition may not, in the present state of our knowledge, be really demonstrable. Leaving this

[1] 11th Fasciculus. [2] Ibid. Plate III. fig. 3.

point, then, as at present, doubtful,—probable, but not proved,—I shall proceed to consider the circumstances usually preceding, or coincident with this coagulation of fibrin in the heart of the living body; and to enquire if they are such as would probably lead to the formation of concretions.

I am induced here to enter upon this question, in consequence of Dr. Babington, the writer of an excellent article "On the morbid conditions of the blood," in the "Cyclopædia of Anatomy and Physiology," having expressed considerable doubt whether that fluid is ever coagulated in the heart during life, and stated his conviction that such coagulation is, to say the least, very unfrequent. I have already observed that, in the arteries and veins, coagulation takes place from inflammation or disease of their lining membrane —from retardation of the flow of blood, or from a combination of the two—probably assisted by a peculiar, but at present unascertained, condition of the fluid itself. I have also stated, that it is impossible to suppose but that some motion must exist between the particles of the fluid contents of an aneurismal sac, or a diseased or tied vessel, when the process of coagulation commences.—I now proceed to enquire, What are the circumstances, what is the state of the fluid, what the condition of the heart, at the period when fibrinous concretions are supposed to take place within its cavities?

The cases in which they occur are almost universally either chronic disease of the heart, extensive disease of the lungs or pleura, or endocarditis. For the present, passing over the two latter, I select for consideration a heart on the valves of which considerable deposition has taken place: the apertures which they close are thereby contracted, and the regular transit of the blood is impeded. Dilatation of one or more of the cavities is sooner or later the result; and, as a necessary consequence, the blood accumulates, and the difficulty of propelling it increases: together with dilatation, usually occur thickening, opacity, and sometimes a certain degree of roughness of the lining membrane. The organ, oppressed by the increase of fluid, contracts feebly, and is capable of expelling only a comparatively small portion of its contents; the vital energy is often considerably diminished;—and "fibrin coagulates," as Dr. Babington states, "the more speedily in proportion as the circulating and nervous systems become more feeble." Syncope is not unfrequent; than which nothing, perhaps, excepting dissolution, is more conducive to coagulation. If, then, to all this we add, that, in a majority of these cases, a considerable quantity of the more fluid part of the blood is removed from the circulation by effusion into the serous cavities and cellular membrane, and that the blood is therefore probably richer in fibrin (as indeed is indicated by the thick glutinous, tar-like characrer it presents, and the speedy coagulation it undergoes, when taken from the arm by venesection,) and that, as will afterwards be shown, these concretions usually occur posteriorly to some obvious obstruction or in largely dilated cavities,

there will, I think, be ample grounds for assuming, at least, the probability of their formation previous to death.

"That the firmness of a polypus affords no proof that it existed during life," I am quite willing to admit; and, "that a colourless clot left in the larger cavities and vessels, and moulded into their exact shape, may be formed after death," I am by no means prepared, or disposed, to deny. But Dr. Babington will, I trust, excuse me for differing from him, when he states his conviction that "rest is absolutely necessary to the formation of a firm clot;" and when I express my belief, that it is not always the firmest clots which bear the most decided indications of being formed during life; and that it is precisely when they are not "moulded into the exact shape of the cavities in which they are lodged," that the evidence of their existence prior to death is most complete. I may also, perhaps, be permitted to observe, that the examples referred to by him, in the works of Hewson and Andral, in which collections of fluid were found in the crassamentum of blood abstracted from the arm—and in which "a homogeneous purulent fluid, of a deep-brown or dirty gray colour, was formed at the bottom of the basin"—are entirely distinct from the globular cyst-like bodies, containing fluid, occasionally found in the cavities of the heart.

I have only further to remark hereupon, that if the possibility of these concretions occurring in the living body be granted, the *frequency* of the fact will be differently estimated, according to individual experience, attention to the subject, and the notion entertained of the applicability of a term which is purely comparative. Having now referred to, and in some degree, at least, deprived of their force the objections of the most recent of modern opponents of the opinions I entertain, I proceed to the description of the bodies themselves:—and in the first place,

Of fibrinous concretions resulting from retardation of the blood.

That coagula are very frequently found in the heart, after death, is a fact familiar to the merest tyro in pathological anatomy. Large or small, soft or firm, white or purple, they are seen in almost all cases which are examined; and their absence may be certainly considered the exception to a general rule. They usually exist either in the form of a large blackish purple mass, of the colour and consistence of black currant jelly, like the under surface of the crassamentum of blood taken from the arm; or, like it, they sometimes consist of two portions—one, dark, soft, and friable; the other, either tremulous, yellow and transparent from the admixture of serum, or of a dead-white or pale fawn colour, and perfectly opaque; or, finally, they are entirely destitute of red particles, which, as described by Dr. Babington, may have separated from the liquor sanguinis, in consequence of the slow coagulation of the fibrin, and either passed into the large vessels from gravitation, or entered the tissues by imbibition.

To Corvisart is usually attributed the merit of first attempting, in

modern times, to distinguish these genuine post-mortem coagula from polypi, or fibrinous concretions formed previous to death. The principal characteristics of the latter, in his opinion, are a fibrous texture—a firm consistence—adhesion to the parietes—and a pinkish white colour. Laennec adopts nearly the same view of the subject; adding, however, that there occasionally exists in the centre an isolated clot of blood; and, on the surface, red spots, which are not removable by frequent ablutions, which penetrate the mass a quarter of a line or more, and which he considers to be the rudiments of future vessels.

If the whole of these characters were present in any individual case, I should certainly have no doubt that the concretions in which they occurred had a date anterior to death; but I think that the majority may exist in cadaveric clots, and also that tolerably decided presumptive evidence of prior existence may be found when most of them are absent.

What, then, are the physical characters, or attendant circumstances, from which we may derive a positive opinion upon this matter? I conceive we may speak decidedly of concretions being formed anteriorly to death: 1st, When strict adhesion exists between them and the plain surfaces of the heart; and particularly when the membrane, from which they are detached, is found rough, vascular, and sprinkled with bloody points. 2dly, When a firm white fibrinous mass is found in one of the cavities, entirely separate, and detached from a dark-purple or mixed coagulum filling up the remaining portion of the same cavity. 3dly, When, after the removal of the easily separable coagulated blood, we leave behind a smooth unbroken layer or coating of fibrin, attached to a portion or the whole of the cavity in which that coagulated blood was previously lodged; though the layer or coating may be adherent simply by passing behind and mixing with the musculi pectinati of that part of the organ to which it is attached. 4thly, When any changes, vital or chemical, the result of organisation or degeneration, are observed in the concretion, which are not to be discovered in any other coagula existing in the same heart. I wish it to be distinctly understood, that I by no means deny the anterior formation of concretions not possessing the characters referred to, but simply, that, when they are present, I consider the evidence of the fact decided and incontrovertible.

I have adopted this opinion from the following considerations.—Adhesion is a vital process, and is never found to exist between the lining membrane of the vessels and the cadaveric clots. Defined, detached, smooth portions of fibrin (judging from what is observed to take place in coagulation of the blood and the separation of that substance when removed from the body) must, whether in the form of solid masses or extended layers, be formed at a period distinct from coagula, differing in density, colour, and other physical characters with which they co-exist, with which they are in contact, but to which they are not connected; and as there is no reason, with

which I am acquainted, to suppose that two separate processes of solidification can or do take place in the blood of the same cavity after death—and we are well assured that the large soft coagula are genuine post-mortem productions—the inference is clear, that the small attached fibrinous concretions are formed during life. The same, with some slight modifications, may be said of those examples in which chemical or other changes are observed in these bodies; unless it can be supposed probable that poisonous or morbific matter can act upon a very small portion of the blood, and, at the same time, leave unaffected the general mass of the circulating fluid.

On the physical characters of fibrinous concretions, the result of retardation of the blood.

These may, I think, be arranged under four varieties; which I have, for the sake of distinction, named the *Polypoid*, the *Massive*, the *Parietal*, and the *Globular*.

The early state of the first, or *Polypoid* variety, I have never witnessed, nor do I recollect to have seen it described. It is usually presented to notice in the form of a solid mass of fibrin, of an irregularly rounded form, varying in size from a filbert to a pullet's egg—is generally of a dull opake or dead white colour, with a smooth even surface, which, however, is sometimes marked with wrinkles or irregular depressions, arising, apparently, from the varying degrees of contraction of different parts; it is sometimes attached by a broad base; at others connected by a small narrow pedicle to the surface of the cavity in which it is lodged; and is often covered with a delicate membrane, which appears to have been occasionally injected from the coronary arteries. Internally, it varies according to its age, and the degree of softening or decomposition which it has undergone. It may be firm, uniform, and lamellated—may be (in appearance at least) supplied with blood-vessels, and interspersed with specks of bone—or may consist of loosely cohering portions of fibrin, varying in colour and in size, and easily reduced by pressure to a soft pulpy mass.

2. The *Massive* is that variety, the date of which there exists the greatest difficulty in determining. Its figure is exceedingly irregular; as various processes or prolongations arise from its surfaces or edges, and pass into the depressions, or through the outlets of the cavity in which it is situated. When most decidedly anti-cadaveric, it is thin and expanded, of a pinkish white colour; firm in texture; easily separable into layers; and attached to some of the plain surfaces of the organ by simple adhesion. Though this adhesion is generally easily broken down, the separation of the parts requires, notwithstanding, continued traction, like a recently effused false membrane, or a piece of paper moistened with gum-water; and sometimes leaves the surface of the membrane deficient in its natural smooth glistening appearance. The adhesion, however, is principally dependent on processes passing behind and

around the musculi pectinati or tendinous cords; or on prolongations entering other cavities, or the commencement of the large vessels through which it leaves a free but considerably narrowed channel for the passage of the blood. The large, firm, white masses of fibrin, so frequently found in the heart after death, evidently very nearly resemble the variety now under consideration, and differ from it simply in the period of their formation.

It is often difficult to decide whether they have been formed during life, or are simply post-mortem coagula. However probable it may appear that certain coagula may have been produced during the last moments of life, I think it impossible to determine the point, unless there co-exist appearances or circumstances which cannot be explained by any cadaveric process. I do not therefore consider their existence previous to death decidedly proved, unless they adhere to plain surfaces of some of the parts with which they are connected; or unless in the same cavity with them and perfectly detached, or easily separable from them, there exists a clot possessing different physical characters, and evidently of more recent formation.

3. Of the *Parietal*.—I recollect to have seen but one example in a recent state. The concretion consisted of a general fibrinous lining of the cavity in which it was formed; and presented an irregular sort of net-work of fibrous bands, about a line thick and two lines broad, of a yellowish white colour, firm in consistence, and with a smooth glistening surface. As each band was connected with one or more in its vicinity, the whole presented the general appearance of the interior of the ventricle in which it was situated; the parietes of which it nearly covered, but to which it was only mechanically attached by intermingling with the musculi pectinati. It contained a large blackish clot, with which it was not even slightly connected.

4. The *Globular*, the "végétations globuleuses" of Laennec, vary considerably in size and figure; sometimes not larger than a small pea: they not unfrequently attain the dimensions of a pigeon's, and more rarely of a pullet's egg. When situated in the ventricles, they are usually of a globular, but sometimes, and particularly if large, of an oval figure. Their colour is either an opake white, a light dirty brown, or a brownish red. Their external surface is generally smooth and even. When large and of considerable standing, they are usually cystiform, and contain fluid. The parietes of the cyst are seldom more than a line in thickness, but are nevertheless often separable into concentric layers, of which the external is the most firm, and which gradually decrease in density as they are more internal; so that the loose and uneven lining scarcely exceeds the consistence of paste.

The fluid they contain is very variable: sometimes it resembles thin and impure venous blood; sometimes it is a thick violet-coloured compound of red particles and fibrin, not unaptly compared to wine lees; at others it is of a dirty brownish-yellow colour, not unlike the inflammatory effusion of the serous cavities in persons

of bad constitutions or low power: and, lastly, it has been stated that it is sometimes pure pus; but this I have never myself observed and it is a circumstance of which I entertain considerable doubt. When small, these concretions are often pyriform in shape, and nearly or quite solid; the centre being occupied by either a small clot or a little black blood. They are ordinarily connected to the parietes of the heart by thick short pedicles, which are said to be generally of more recent formation than the concretions themselves, and which are fixed simply by passing behind the muscular bands of the organ. I have however observed, not unfrequently, that when of considerable magnitude they have no pedicles; but that they adhere, by their general surface, to the lining of some natural or abnormal cavity or depression; or that they are only very slightly connected to the parietes of the ventricle by a portion of their external covering.

When situated in the appendices of the auricles, they vary, in some important particulars, from those I have heretofore referred to. Thus, instead of assuming a form more or less approaching the spheroidal, they usually partake of the general shape of cavity in which they are lodged, and which they nearly fill. Their extremities, however, towards the apex of the appendix and the sinuses of the auricle are frequently rounded off; and the latter often presents a mammillary projection into the general cavity. They are also not unfrequently differently coloured; some portions being of a deep purple or a purplish-brown, and others of a dirty or tawny white. Again, they vary from those found in the ventricles, in being sometimes composed of small granular portions of fibrin, resembling the contents of scrofulous tumours; and in sometimes containing two or more cavities, which are of an irregular form, and do not communicate with each other.

On the situation of fibrinous concretions arising from retardation of the blood.

Most authors appear to suppose that these bodies occur most frequently on the right side of the heart: but from the following table, marking their position in several instances, this opinion seems not to be altogether correct. In reference to the table, I may observe, that it has been prepared, with considerable care, from the cases published by the modern authors whom I have consulted—from the preparations contained in the museums of this city, which I have inspected—and from examples witnessed by myself; and that apparent evidence of a date anterior to death has alone influenced me in the selection. With one or two doubtful exceptions, at most, they may be all considered to belong to the species now under consideration.

No.	Authority.	SITUATION OF CONCRETION. Right Auric.	Right Vent.	Left Auric.	Left Vent.	CAUSE OF OBSTRUCTION OR RETARDATION OF THE BLOOD; AND OBSERVATIONS.
1.	Crewell.	. .	——	. .	. .	ossification of auricle and ventricle.
2.	Corvisart.	. .	——	. .	. .	dilatation of the right side.
3.	Id.	. .	. .	. .	——	diseased heart, (probably ulceration of the lining membrane also.
4.	Burns.	. .	. .	. .	——	excrescences on the aortic valves.
5.	Id.	. .	. .	——	. .	diseased mitral valve, and ossification of auricle.
6.	Id.	——	. .	. .	. .	great dilatation of the right side of the heart.
7.	Hodgson.	. .	. .	——	. .	disease of the mitral valve.
8.	Id.	. .	. .	. .	——	extreme thinning of the left ventricle.
9.	Laennec.	. .	——	. .	. .	yellow softening of the heart, combined with phthisis.
10.	Id.	. .	——	. .	. .	pulmonary apoplexy, and diseased mitral valve.
11.	Rigacci.	. .	. .	. .	——	extreme thinning of the left ventricle.
12.	Dr. Bright.	. .	——	. .	. .	great dilatation and thinning of right side; emphysema of lungs.
13.	Id.	——	. .	. .	. .	emphysema of the lungs.
14.	Uncertain.	——	——	——	——	none mentioned: paient died of renal dropsy.
15.	Dr. Hope.	. .	. .	. .	——	great dilatation of the ventricle.
16.	Id.	. .	. .	——	. .	diseased mitral valve.
17.	Bouillaud.	——	——	. .	. .	none mentioned: patient suffered from hæmoptysis.
18.	Id.	——	. .	. .	. .	none mentioned.
19.	Id.	. .	. .	——	. .	diseased mitral valve.
20.	Id.	——	——	. .	. .	dilatation of right side: diseased tricuspid and mitral valve.
21.	Id.	. .	——	. .	. .	rupture of tendinous cords.
22.	Id.	. .	——	. .	. .	diseased mitral valve.
23.	Dr. Watson, quoted by Dr. G. Burrows.	——	——	. .	——	dilatation and hydro-pericardium.
24.	Legroux.	——	——	. .	. .	dilatation and adhesion of heart to sternum.
25.	Id.	. .	. .	——	——	diseased mitral valve.
26.	Id.	. .	. .	——	. .	diseased, mitral, tricuspid and aortic valves.
27.	Id.	. .	. .	——	. .	diseased mitral valve.
28.	Id.	. .	. .	. .	——	general ossification of the arteries.
29.	Id.	. .	——	. .	. .	phthisis: none other mentioned.
30.	Id.	. .	——	. .	——	dilatation and softening of muscular parietes.
31.	Id.	. .	——	. .	. .	thinning of the ventricle; age 86.
32.	Museum of Guy's Hospital.	——	. .	. .	. .	dilatation of auricle and open foramen ovale.
33.	Id.	. .	. .	. .	——	none visible.
34.	Id.	. .	——	. .	. .	hepatisation of the lung, age advanced.
35.	Id.	——	. .	. .	——	great dilatation.

No.	Authority.	SITUATION OF CONCRETION. Right		Left		CAUSE OF OBSTRUCTION, OR RETARDATION OF THE BLOOD; AND OBSERVATIONS.
		Auric.	Vent.	Auric.	ent.	
36.	Museum of Guy's Hospital.	..	..	..	——	aneurismal dilatation of the apex of ventricle.
37.	Id.	..	..	..	..	disease of mitral valve.
38.	Id.	..	..	——	——	dilatation; diseased mitral and aortic valves.
39.	Id.	..	..	..	——	open foramen ovale.
40.	Id.	..	..	..	——	dilatation and rupture of the apex of ventricle.
41.	Insp. Book, Ditto,	..	..	——	——	pericarditis and hydro-pericardium.
42.	Museum of St. Thomas's Hosp.	..	..	..	——	disease of aortic valves.
43.	Id.	——	..	..	..	tricuspid and aortic valves diseased.
44.	Id.	..	..	——	..	disease of mitral valve, and dilatation.
45.	Museum of Bartholomew's Hosp.	..	..	..	——	dilatation.
46.	Id.	..	..	..	——	dilatation and ulceration of the apex of the ventricle.
47.	Id.	..	..	..	——	none observed: parietes of ventricle rather thin.
48.	Id.	..	..	——	..	diseased mitral valve. and dilatation.
49.	Mr. Key.	——	..	..	..	opening between the auricles.
50.	Museum of College of Surgeons.	..	——	..	..	dilatation.
51.	..	..	——	..	..	dilatation.
52.	..	..	——	..	——	aneurismal dilatation.
53.	..	..	..	..	——	diseased aortic valves, and aneurismal dilatation.
54.	..	..	..	——	..	dilatation of the left ventricle.
55.	..	——	..	..	..	none visible.
56.	..	..	..	..	——	large carotid aneurism.
57.	Dr. Hughes.	..	..	..	——	small aorta: disease of aortic and mitral valves.
58.	Id.	..	..	..	——	dilatation of the ventricle; diseased mitral and aortic valves.
59.	Id.	——	..	——	..	diseased mitral and aortic valves.
60.	Id.	..	——	..	..	pulmonary apoplexy, and dilatation of auricle.
61.	Id.	——	..	..	..	pulmonary apoplexy: hydrothorax; coagulum in one of the aortic valves.
62.	Id.	..	——	..	——	consolidation of the right lung, and aneurisms of the aorta.

From this table it will be seen, that out of 62 examples, concretions have existed in

32 on the right side of the heart.
38 on the left.
15 in the right auricle.
21 in the right ventricle.
14 in the left auricle.
27 in the left ventricle.

7 in the right and left side at the same time.
4 in the right auricle and ventricle.
3 in the left auricle and ventricle.
2 in both auricles.
6 in both ventricles.
1 in all the cavities.
1 in the right auricle and ventricle, and left ventricle.
1 in the right auricle and left ventricle.

The preceding table refers to all the varieties of fibrinous concretions resulting from retardation. The different varieties, however, appear to me to affect particular situations, which require a very few words. According to my own observation, the first, or polypoid, is generally attached to the septum of the auricles (usually the right), but occasionally, also, to the septum of the ventricles.

The second, or massive, is occasionally found in each and all of the cavities.

The third, or parietal, appears to be most common in the ventricles; as, of the three examples with which I am acquainted, two existed in the right, and one in the left ventricle.

The fourth, or globular, are always, I believe, situated in the ventricles or the appendices of the auricles.

On the mode of formation, age, and changes of these concretions.

When a considerable obstruction exists to the passage of the blood through the heart, whether arising from disease of the valves, aneurism of the aorta, or other causes, one of two conditions usually results. Either an increased thickness of the muscular parietes, constituting hypertrophy, is produced by undue nutrition of the organ—by which it is enabled to overcome that obstruction of which the hypertrophy is the indirect consequence, and to propel the blood into the extreme vessels of the distant parts of the body; or, if the increased nutrition of the organ be unequal to the undue obstruction of the circulation, a state of distention necessarily occurs in one or more of the cavities, from an accumulation of blood. This state of distention is as persistent as its cause; and produces ultimately, a gradual yielding of the parietes; and thereby leads, in a longer or shorter period, to dilatation of the organ. These effects of obstruction may be either single, or combined in different degrees in different individuals. The particular form of the disease is probably, in a great measure, influenced by the relative constitutional vigour of the person in whom it occurs. In proportion as one or more of the cavities becomes dilated, especially if unaccompanied with hypertrophy, the heart experiences a greater difficulty in propelling the blood, and a larger quantity of this fluid is left behind at each contraction of the ventricles. The disease therefore advances, both by the increase of the obstruction, and by the decrease of the ability to surmount it. A portion of blood farthest removed from the direct current of the circulation, after the expiration of a certain time, is, I suppose, left in a state of comparative rest, at least equal

to that existing in the fluid contents of a small aneurism, or of a diseased vessel when they first assume the solid form.

Independently of this state of comparative rest, however, the blood, in long-standing diseases of the heart, is, as I have previously observed, often peculiarly prone to coagulation; as is proved by the short time required for its solidification, when taken from the arm. A diseased, inflamed, or roughened state of the lining membrane of the organ also frequently exists; and the general condition of the patient is usually such as materially to favour the process. If, then, under such circumstances, the circulation be more than usually disturbed, and the contractions of the heart become irregular, unequal, and intermitting, as well as feeble—or especially if the patient is suddenly attacked with syncope—that portion of the blood which is farthest removed from the direct current, and which, during the scarcely more than tremulous movements of the organ, may remain, not only almost motionless, but unmixed with the general stream gently undulating through it, coagulates, and afterwards forms a concretion, varying in colour and consistence according to the celerity or tardiness with which it becomes solid, the degree of contraction it undergoes, and the subsequent condition of the individual in whom it occurs.

The preceding view of the mode of formation of these concretions derives, I think, considerable support from the preceding table: from which it may be observed, that these masses of fibrin have, in a great majority of cases, existed in that portion of the heart, in, or immediately anterior to which there has been some obvious cause of retardation. In some of those in which this condition has not been satisfactorily established, I think it more than probable that the deficiency has arisen from the brevity of the narrator, or the too free use of the scalpel of the morbid anatomist. To what circumstances is attributable the form assumed by these concretions, in any particular case, I must confess my inability to determine. I may, however, observe, that the variety which I have named the polypoid has appeared to me, generally, to co-exist with either an open foramen ovale, or a diseased condition of the parietes of the cavity in which it was lodged. The mode of formation of, and the particular figure assumed by, the globular variety, is very difficult to explain. After some consideration of all the attendant circumstances, I am induced to believe, that when they occur in the ventricles, coagulation of the blood first takes place in one of the enlarged depressions, between the musculi pectinati, or in the dilated apex of the cavity; that the coagula remain for a time stationary; but that they are dislodged from their moulds, either on the subsidence of the aggravated attack of dyspnœa or syncope which contributed to their occurrence, and the consequent return of the ordinary power of contraction of the heart; or by one of those violent propulsive efforts, frequently observed by the auscultator, when the action of the organ is irregular and unequal. The concretions, thus formed, remain attached by portions of fibrin

coagulated at the same time, but incapable of being moved from their situation in consequence of passing behind and around the musculi pectinati, and acquire a globular figure by the uniform pressure of the fluid by which they are surrounded. The fibrin is sometimes arranged in concentric layers, in consequence of coagulation occurring, subsequently to their formation, on the external surface of these concretions; as the coagulum in an aneurism increases by successive depositions upon its internal surface. I am induced to adopt this view of the process, from having observed, that, when small, they are attached close to a depression capable, or nearly capable, of containing them; that, when large, they usually co-exist with a notable thinning, or aneurismal dilatation of the ventricle; that their rounded surfaces are sometimes seen peeping out between the muscular bands;[1] and that, when situated in the appendix of the auricle, they generally pretty nearly fill the cavity, and assume its form, with the exception of a mammillary projection towards the current of blood. Mr. Thurnham, in an otherwise very valuable paper on Aneurism of the Heart, published in vol. xxi. of the Med. Chirurg. Transactions, gives the following explanation of the formation of the dilated apex of a ventricle which contains one of these bodies, and of which the preparation is in the College of Surgeons:—"The thinnest part of the walls of the ventricle was the seat of a foreign body, by which it must have been compressed during the contractions of the heart. As a consequence of this, atrophy of the heart ensued; then fibro-cellular degeneration; and, lastly, the dilatation of the part."[2] From these opinions I need scarcely say I entirely dissent.

As the symptoms attending the formation of these concretions are generally obscure, and the time at which coagulation commenced is therefore frequently a matter of conjecture, and always incapable of direct proof, the exact age of a particular example is generally undeterminable. There are some instances, however, in which the condition of a patient, some time before death, is so extremely favourable to their production, and the symptoms following that condition are so precisely those which would probably result from their presence in one of the cavities of the heart, that no doubt could, I think, exist in the mind of an unprejudiced observer, on seeing the concretion after death, that it and the previous symptoms had been related as cause and effect. A remarkable case, in reference to the age of these bodies, has been related by M. Legroux:[3]—A woman, suffering from symptoms of diseased heart, was suddenly seized with paralysis, and loss of pulsation in the left arm, terminating in dry gangrene of the part. She died suddenly, eighteen days after; and, on examination, there was found a very diseased

[1] See plate i. fig. 3; also plate iii. fig. 2: in the Medico-Chirurgical Transactions, vol. xxi.

[2] P. 214.

[3] Recherches sur les concrétions sanguines, p. 13.

mitral valve. The brachial and ulnar arteries were filled by fibrin of a yellowish red colour, granular in texture, easily reduced to pulp by pressure, and adherent to their lining membrane. A concretion of exactly the same colour, texture, and consistence, was discovered in the left auricle, slightly adherent to its parietes, but connected principally by mixing with its muscular columns. The fair and natural presumption is, that both masses of fibrin assumed the solid form about the same time.

Other cases are, however, on record, which bear presumptive evidence of much longer standing. Thus, in a case related by Burns, a mass of fibrin in the left auricle was not only covered with a distinct membrane, but contained specks of bone, and was permeated by air, by inflation of the coronary vessels. In another case by the same author, a concretion was separated with difficulty from its attachment; and when it had been forcibly removed, the membrane was left rough, and painted with red vessels. In a concretion found in the right auricle of a girl, Bouillaud saw vessels filled with bright and dark blood. Rigacci, quoted by Andral, distinctly saw vessels injected with mercury passing along the pedicle, and distributed through the mass of a fibrinous concretion in the left ventricle. In the Museum of Guy's Hospital, is a preparation in which a large fibrinous mass attached to the septum of the auricles has been injected with sise, and in which distinct vessels are now visible.

Case 1.—A woman, aged 55, suffered from the ordinary symptoms of diseased heart, with ascites, anasarca of the legs and left arm, great dyspnœa, and uneasiness of the left side. On examination after death, the heart was found rather dilated. At the margin of the fossa ovalis, which was remarkably distinct, there existed a valvular opening, capable of admitting a crow-quill; close to which was the attachment of a solid concretion, as large as a pullet's egg. Though dark and discoloured at some parts, it was generally of a light yellow colour, and transparent, with some opaque white spots, having a general concentric arrangement distributed through it. Fine injection thrown into the coronary artery passed into minute vessels, ramifying beautifully through the transparent substance: it was covered by thin membrane, which appeared to be continuous with the lining of the auricle. The edges of the auriculo-ventricular valves, particularly the left, were slightly thickened.—(See Inspection Book in Guy's Museum, prep. 1388.

This preparation has lost some of its characteristic features by long maceration in spirit. However accurately it may now resemble a fungous growth from the parietes, and whatever doubt may be felt as to the presence of true vessels by persons now examining it, there was no hesitation on either of these points in the mind of those who saw it in a recent state. I must however acknowledge, that in a preparation in Bartholomew's Museum is a similar mass attached to the septum in the left auricle, which is

considered by Mr. Stanley to have been secreted by the lining membrane of the heart.

It appears, then, by the statements of authors of credit, and by existing preparations, that these concretions may be covered with membrane, supplied with vessels, interspersed with specks of bone, or changed into granular pultaceous masses, according to the degree in which they have been organised, and the action of the vessels of the part with which they are in contact, or the amount of degenerative softening they have undergone; and it is evident that these changes could not have been effected in a very short space of time.

The correctness of the preceding statements may, I am aware, be considered questionable; as there are some who still doubt if a fibrinous clot is capable of organisation under any circumstances; and there are many, who, though conceding the possibility of the occurrence, yet hesitate to admit that it can take place in fibrinous concretions of the heart when the membrane is entire and the powers of life are almost exhausted. As to the general objection, I think it necessary only to state, that branches have been distinctly traced from the parietes of vessels to clots contained within them.[1] As to that which refers particularly to the subject under consideration, I willingly admit that I have no reason to believe that organisation ever exists in fibrinous concretions without some lesion of the lining membrane of the heart; but, at the same time, I must be allowed to express my conviction, that observation by no means justifies the conclusion that these concretions are, in all cases, formed "*in extremis*." The preceding remarks refer solely to the polypoid variety.

The massive and parietal I have never seen present any other characters than those of ordinary fibrin; though some of the cases of Bouillaud and Legroux, in which vital or spontaneous changes had taken place, appear to me to have belonged to the former of these varietes.

On the changes occurring in the globular, much has been written, and different and conflicting opinions expressed. The formation of the fluid resembling pus, occasionally contained within them, has been variously explained by the different authors who have noticed the subject: thus Laennec thinks that it is probably secreted by the parietes of the cyst. Andral expresses different and contrary opinions at different parts of his works. At one part he says: "We must admit they possess an independent vitality, by means of organs they have themselves secreted":—at another he compares them to zoophytes:—again, he states, that if pus exists in other parts of the body, it has been transferred to the coagula by absorption; if not, he is unable to form a rational conjecture as to its origin: and, finally, he appears to consider the fluid merely broken

[1] Vide Carswell, 11th Fasciculus.

down fibrin. Legroux believes that it is the product of inflammation in the cyst;—Bouillaud, that it is either secreted by the heart, or absorbed from other parts of the body; and that, in either case, it forms a sort of nucleus, around which the fibrin coagulates. Dupuytren considered it produced by decomposition, the result of vital heat. Dr. George Burrows thinks it most probably dependent on degeneration of fibrin:—an opinion not materially differing from that last mentioned, and one in which I entirely concur.

I am not aware that the fluid has ever been proved, by microscopic observation, to be true pus: and since my attention has been directed to the subject, I have not had an opportunity of examining it with minute attention. I believe that true pus never exists in these concretions: I have certainly never seen any fluid in them which could be properly so represented. M. Magendie, in one of his lectures, states, that he had examined the fluid contents of a globular mass of *tubercular* matter, which was discovered, after death, entangled between the tendinous cords of one of the valves; and found the particles to differ from those of true pus. This "globular mass of tubercular mattter" I suppose was, in reality, a globular fibrinous concretion:—if so, its examination rather curiously confirms the opinion I have advanced. The formation of the variously coloured fluid may be simply explained in a few words, as follows: A concretion originally produced in the mode I have previously described, and containing many, few, or no red particles, according to the celerity or tardiness with which it originally assumed exteriorly a solid form, and more or less serum in proportion to the amount of subsequent contraction, may not merely not become adherent to the parietes by vascular connection, but may, like tubercular matter, and some inflammatory products, be incapable of organisation. Subject, therefore, to the laws of unorganised or unorganisable matter, that portion containing the most serum or first coagulated, like the fibrin effused in slow forms of pneumonia, gradually softens, and breaks down, or degenerates into a fluid, the physical characters of which depend on the materials of which the concretion was originally composed.

At the same time that the interior softens, the exterior may acquire fresh layers of fibrin, which thus produce the concentrically laminated parietes which these globular concretions not unfrequently possess. It will be seen, then, that I consider the presence of fluid within these globular cysts a proof, not of their advanced organisation, but of their incapability of being organised.

The very few words that I have to say on the subjects of the symptoms and treatment, I shall, to avoid repetition, reserve till I have made some observations.

On fibrinous concretions, the result of inflammation.

These occur in two forms, the warty and the amorphous. T warty fibrinous concretions, or, as they are usually termed "ve

tations of the valves," have been so often and so accurately described, that a few words will here suffice. They differ, in shape, consistence, colour, and firmness of adherence, not only in different hearts, but in the same heart, and on the same valve. They are sometimes seen of a rounded form, with a broad base and a wrinkled surface, like a wood strawberry; or they more nearly resemble venereal warts; they may be conical, like the papillæ on the interior of the cheeks of some ruminant animals, globular, and attached by a small pedicle, oval and flattened; or may present the general appearance of small beads, or grains of wheat. Their colour varies from a dead white or whitish brown, to a semi-transparent pink, or deep violet or purple; and their consistence, from boiled white of egg and tubercular matter, to that of fibro-cartilage. When white externally, they sometimes contain a dark purple clot in the centre, or a drop of dark fluid blood. They are said, occasionally, to be purple externally, and white in the centre, and to be variously coloured on the surface; but of these conditons I cannot speak from observation. Occasionally, and particularly when large, and friable, like a mass of scrofulous matter, they are covered with a delicate membrane; but more generally they are naked, and in immediate contact with the blood. They adhere sometimes so firmly, as not to be detached without removing a portion of the membrane on which they are situated; at others, they may be scraped off with very slight pressure of the nail, or handle of the scalpel.

Of the amorphous concretions I recollect to have seen only a single recent instance; and the heart in which they occurred had been removed from the body, and macerated for some hours. They then appeared in the form of irregularly shaped masses, detached from each other, of a dirty white colour, capable of being separated into layers, but uniform throughout; at one part extended on a broad surface of the ventricle or valve to which they closely adhered, without vascular connection, varying from a line to a line and a half in thickness, and exceeding an inch in their longest transverse measurement; at another, projecting from the surface to which they were attached in a solid mass of the shape and size of the first joint of the little finger.

The situations in which the warty concretions most frequently occur, are upon the mitral and aortic valves: they are found more rarely on the lining of the left auricle, and the tendinous cords attached to the mitral valves, and still less frequently on the tricuspid and pulmonary valves. When on the mitral valves, they are usually placed along its free margin, among the attachments of the tendinous cords, or upon the upper surface of the broad curtain; and when in the situation last mentioned, it is not very uncommon, also, to find them on that portion of the left auricle immediately opposed to it. When upon the aortic valves, they are generally attached—as observed by Dr. Hodgkin and Dr. Watson—to the double festoon, extending from the extremities of the valves to the corpora sesamoidea; but sometimes to the natural free margin, or

the diseased, ruptured, or ulcerated edges. When on the tendinous cords, they are almost always attached to a ruptured extremity, or an inflamed or ulcerated surface. These observations, *mutatis mutandis*, are applicable to the corresponding parts on the right side of the heart. It is, however, a curious fact—to which I have hitherto found not a single exception, which I think has not hitherto been noticed, and as to the cause of which I cannot form even a plausible conjecture—that when attached to the surfaces of the valves, they are uniformly on that side opposed to the direct current of the blood, *i. e.* upon the ventricular side of the sigmoid, and the auricular side of the mitral and tricuspid valves.

The parts to which the amorphous concretions were attached, in the case to which I have referred, were the mitral and tricuspid valves, and the parietes of all the cavities, but particularly those of the left ventricle.

The formation of warty concretions or vegetations has been ascribed to three distinct causes. Laennec regarded them as simple polypiform concretions, resulting from coagulation of the blood; and Andral thinks his opinion is probably correct. Bouillaud considers them, if not the direct, at least the indirect, product of inflammation; and Dr. Hope supposes that they originate in some peculiar condition of the blood, or particular constitution of the individual in whom they exist. My own opinion is, that they are always the direct or indirect result of inflammation, or other disease of the endocardium. It has been customary to regard the thickening of, or deposit in the valves, as the effect of endocarditis; which must, under such circumstances, be regarded as a very common disease. I am, however, disposed to think that it is, in truth, a comparatively rare affection of the heart; and that whereas thickening, puckering, and ossification are produced in the valves of the heart, as in the arteries, by inflammation or altered action of the vessels in the subserous tissues, or cellular layer below the lining membrane, warty concretions or vegetations arise, though sometimes indirectly, from inflammation of the membrane itself. That inflammation is the first step in the process of their formation, I cannot doubt, when I observe the thickened endocardium, to which they are attached, covered with a membrane which may be frequently peeled off, together with the concretions;—that they occur most frequently on the left side of the heart, and on parts most liable to inflammation;—that they are occasionally found upon parts which, from some local cause, have been attacked by, but are not ordinarily obnoxious to, inflammation; and that they often exist without more important disease than thickening, or roughness of the lining membrane. But though inflammation may be the first link in the chain of their formation, it does not therefore follow that they are always its direct product—that they are secretions, or, strictly speaking, vegetations—any more than, because phlebitis is the cause of the formation of a coagulum, it therefore follows that the inflamed vein has secreted the coagulum. I believe, then, that

these vegetations or warty concretions are, at least, sometimes produced by coagulation of the blood upon the inflamed membrane. It is indeed true, that it may be difficult to account for their arrangement and form, but I conceive equally so, whether arising from coagulation or secretion. My reasons for adopting the opinion I have mentioned are the following:—

In endocarditis, the false membrane, as in serous cavities, is generally spread over the affected surfaces in a uniform regular layer; varying in thickness and texture according to the duration and intensity of the disease, and assuming the form (if of long standing) of the lining membrane of the heart itself. This membrane, if carefully sought after, may sometimes (perhaps universally) be found below the vegetations, and peeled off the endocardium, together with them. The inflamed surface is equally covered with this membrane; yet the vegetations are distributed irregularly over it; some portions being perfectly free, and no ulceration being discoverable on those spots to which they are attached, and by the vessels of which they are supposed to be secreted. Though they are certainly found upon the ruptured extremities of the tendinous cords and the ulcerated edges of the valves, yet they generally extend far beyond the ruptured extremities, and often occupy only a small portion of the ulcerated edges; neither of which circumstances would probably occur, if simple exudation was the only source from which they were derived.

What I have hitherto stated, however, is, I must allow, in a great degree conjectural, and cannot be fairly considered as proof of the truth of my position. Of a different character is, I conceive, the fact, that not unfrequently, if examined with attention, one or more of these so called vegetations will be found to be globular, attached by a pedicle to the inflamed surface, white and smooth on the exterior, soft in texture, and to contain in the centre either a little fluid blood, or a minute purple clot; to present, in fact, all the characters of globular fibrinous concretions of small size, which I cannot conceive to be secretions from an inflamed surface.

The formation of what I have termed the amorphous fibrinous concretions appears to be much more simple. Thus, I suppose, it may be easily understood, and will be generally conceded, that inflammation of the endocardium, covering either the valves or the parietes, by destroying its smooth glistening surface, may so impede the motion of the blood, or so change or modify its properties, as to induce its coagulation upon the parts affected, as upon the membrane of an inflamed vein; and that the fibrin, thus separated, may increase in extent and thickness, according to the severity and duration of the disease, the activity of the circulation, and constitutional vigour of the patient.

On the symptoms of fibrinous concretions &c.

I think it unnecessary to state the opinions of authors upon the nature of the symptoms resulting from concretions induced by retardation of the blood; as they, for the most part, agree that these bodies sometimes exist without any indications of their presence, and as they do not materially differ, as far as I have been able to ascertain, in their accounts of the sufferings to which they occasionally give rise. I may, however, remark, that M. Legroux observed, in several instances, violent symptoms of gastric irritation, without any indication of lesion of the stomach being found after death: and that he fancies, that if a sudden and notable diminution of the ordinary sounds of the heart occurs over one or more of the cavities, particularly if, coincidentally with this diminution of sound, appear the more commonly recognised symptoms of their formation, fibrinous concretions may be confidently predicted.—Dr. Hope has given, as it appears to me, a more correct account of the symptoms than any author with whom I am acquainted. He says, that if their formation is gradual—as in those concretions existing a long time before death—their presence is not easily detected; that concretions of the globular variety are often present without any symptoms; and that they are usually found in those who have been moribund for days, or even weeks, before their end;—but that if, in conjunction with an increasedly irregular and confused action of the heart, there be a sudden and excessive aggravation of dyspnœa, without any obvious cause, the patient being in agony from an intolerable sense of suffocation, remaining restless and distressed till death, with cool surface and extremities, and a livid countenance, occasionally accompanied with nausea and vomiting, the presence of a fibrinous concretion in the heart may be almost certainly predicted.—From what I have been able to collect from the records of cases I have examined, I am induced to believe that the variety I have termed polypoid may exist without any symptoms distinguishable from those of dilatation of the cavity in which it is lodged, while it remains adherent to the parietes; but that it is sometimes the cause of instant death, by blocking up one of the apertures of the organ.

The following case, for which I am indebted to Mr. Key, may be quoted as an illustration:—

Case 2.—An odd-looking boy, aged about 11, in the London Orphan Asylum, had been rather unwell, and placed, in consequence, in the infirmary for three days, when he suddenly expired in the act of passing his fæces. A large opening was found to exist between the auricles; but the cause of death was an old and firm fibrinous concretion, the size of a pigeon's egg, which was attached to the parietes of the auricle, and had blocked up three fourths of the right auriculo-ventricular opening. It had become entangled in the cords of the tricuspid valve, and prevented the blood passing into the lungs.—There is a preparation in the Museum of the

College of Surgeons, in which a round, and apparently lamellated, concretion, as large as a pullet's egg, has been forced into the same opening of a very large heart. Death in this case was probably equally sudden, as there appears to be scarcely any opening for the passage of the blood.[1]

I can even conceive, that, in a largely dilated cavity, a body of this kind may, like the coagula in an aneurismal sac, be rather advantageous to the patient; not simply, or principally, by preventing a rupture of the cavity, but by decreasing its fluid contents, and thereby facilitating the circulation. Of the symptoms of the massive variety, I have nothing to add to the statements of Dr. Hope; excepting, that it is to this variety that I believe those symptoms more particularly belong.

The following case is so interesting, independently of the concretions, that I am induced to relate it more at length:—

Case 3—James Restall, aged 40, a man of small stature, and of melancholic temperament, came under my care in June 1836. He had formerly been, by trade, a hatter; and at that time fared badly, and drank intemperately: but for eleven years, since his marriage, he had lived more regularly; and for the last five years had been employed as a common labourer. For the whole of this latter period, he had been the subject of cough during the winter; and for about six months had observed a pulsating on the right side of the neck. A month before I saw him, he for the first time experienced pain of the chest: the tumour increased in size, and the cough in severity. When first seen, there existed a soft pulsating tumour above the right clavicle, to the outer side of the sterno-clavicular articulation: he had no disphagia, nor was the tumour materially affected by the act of swallowing: there was no tenderness about the part, or redness of the skin, which moved freely over it. He was himself sensible of the pulsation; was unable to assume a perfectly recumbent position; and was often obliged quickly to get up, from a sense of impending suffocation; his cough was frequent and short, with muco-purulent expectoration: dyspnœa, when quiet, was not considerable; and he walked slowly, without much inconvenience: but he frequently suffered from palpitation, with pain between the scapulæ, or of the right shoulder; the complexion was sallow and muddy; the countenance expressive of distress: the features shrunk: the tongue natural; and the pulse 120, regular, but extremely feeble.

Physical symptoms.—The chest was tolerably resonant on percussion, excepting at the upper part of the sternum, below the clavicle, and over the right scapulæ, where considerable dulness existed. The respiratory murmur was feeble, but natural on the left side; but upon the right side was quite obscured by a loud, harsh bronchial rhoncus, arising apparently from pressure. The voice was hollow and sepulchral, and below the right clavicle was

[1] It is among the unarranged preparations, and has no number attached to it.

considerably louder than natural. There was no unusual dulness in the præcordial region: the sounds of the heart were feeble, but pure: the rhythm natural, and the impulse was exceedingly small. There was no bruit or impulse on the right side, or over the first bone of the sternum, but the sounds of the heart were here heard with unnatural distinctness. These symptoms led me to form the following diagnosis:—"Aneurism of the arteria innominata—enlarged arch of aorta—tubercular consolidation of apex of right lung—a weak, feeble heart, with little or no valvular disease." Rest and abstinence, with mild sedatives and diuretics, occasional aperients, and a belladonna plaster, were prescribed.

About a fortnight after, on awaking one morning, he found the tumour had entirely disappeared. On diligent examination, no tumour could be found, nor was ever after discovered, either behind the clavicles or sternum; and the only apparent remains of it existed in the evidently larger size and fuller pulsation of the right than the left subclavian artery, as it passed over the first rib. At the same time, however, the dyspnœa became troublesome; the act of swallowing impeded and difficult; the expectoration considerably more abundant, and more decidedly purulent; and, a few days after, was, for two or three days, streaked with blood. He now began to waste rapidly; his features became pointed; his countenance more anxious; and his general appearance was that of a person in advanced phthisis. Sulphuric acid during the day—hydrochlorate of morphia at night—frequently repeated blisters below the right clavicle, in consequence of the pain, now pretty constantly experienced, afforded him considerable relief;—and no particular change occurred till Sept. 28th, when his dyspnœa became distressing, and orthopnœa occurred in more frequent paroxysms; and he was frequently convulsed during his sleep, till he was relieved by expectorating, with several violent fits of coughing, about six ounces of a thick viscid muco-purulent matter of a dingy-red or rust colour, from the admixture and thorough incorporation of blood. It was observed, that this did not consist of one perfectly cohering mass, but that the different portions remained partially separate, like the rounded pellets expectorated in some cases of phthisis, and appeared, in fact, to be the sputa of a chronic pneumonia. The chest was still resonant on percussion, except at the parts formerly noticed. Under the right clavicle, a loud harsh rhoncus was still heard, and bronchophony, but no pectoriloquism, was discernible. The diagnosis was now somewhat modified, chronic pneumonia being considered the cause of the consolidation of the lung. He was now ordered mild expectorants; and the little digitalis, which he had previously taken in a diuretic mixture, was withdrawn in consequence of his increasing debility.

Oct. 4. The expectoration was now, and for a day or two had been, muco-purulent, without the slightest trace of blood: still, by the slight examination practicable in his debilitated condition,

together with the quickness of his respiration, and the consequent weakness of his voice, no pectoriloquism could be discovered.

Oct. 5. He was seized with increased distress of respiration, gasping, and constant sense of suffocation; he could not speak, and could scarcely swallow: his aspect was wild: his eyelids widely separated: his countenance anxious in the extreme, and the pulse scarcely perceptible. Stimulants were freely administered, but without effect, as, after lying in a state of extreme distress and constant restlessness for twenty-four hours he expired.

SECTIO CADAVERIS, twenty-four hours after death.—The body was much emaciated, and without any appearance of œdema. The chest alone was examined. On the right side, the pleura was not adherent, and contained but little fluid. The whole of the upper lobe of the lung was consolidated, and scarcely permeable by air. It was soft, pulpy, easily lacerable by slight pressure of the finger, of a dark-olive reddish-brown colour, with a few just-softening tubercles sprinkled throughout its whole extent. Nearly in the centre was an irregular cavity, almost capable, if distended, of containing a pullet's egg. It was without lining membrane, its surface being flocculent, its parietes loose and soft, and of a dirty olive colour, but without any fetor. It contained a little dark brown fluid, similar to that which escaped from the cut surface of the lung on pressure. The lower lobes were very œdematous; and the bronchial tubes yielded, by pressure, an abundant supply of mucopurulent fluid. These portions of lung were not consolidated at any part; and contained no tubercles, in any stage. The pleura on the left side was not adherent, and contained about half a pint of dark-coloured serum: the lungs posteriorly were in a state of congestion and softening, arising probably from gravitation; the lower lobe was partly emphysematous, and in part distended by œdema: the bronchial tubes here also contained much puriform mucus; and their lining membrane was thickened, and dark from injection; no tubercles were discovered. In the front of the trachea, the lining membrane of which was otherwise tolerably healthy, was an ulcerated opening, about the size of a goose quill, filled up by fibrin, and communicating with an aneurism of the aorta. The pericardium was healthy; the heart natural in size and colour, but soft in texture, and easily broken down by pressure. The pulmonary valves were healthy, excepting the presence of the rudiment of a fourth curtain; the tricuspid and aortic were also free from disease; but the mitral was rather thicker, and less transparent, than in the normal condition. In both ventricles, independently of and unattached to, the common soft coagula constantly found in the heart was a thin and flat fibrinous concretion, quite opaque, firm, and of a pinkish-white colour, easily separable into fibrous bands like muscle, and presenting, on the transverse section, a spotted surface, somewhat resembling a divided nerve. They were both adherent, not simply by entering into the depressions and anfractuosities of the muscular parietes, and mixing with the tendons, of the

valves, but also to plain surfaces, from which they separated like false membrane, or paper moistened with thin gum and water: they passed only a short way into the auricles, and were quite distinct from the coagulated blood which distended all the cavities. The ascending portion and arch of the aorta were much dilated and diseased; their lining membrane being wrinkled and puckered, and having beneath it patches of soft opaque yellow matter at some parts, and, at others, spots of bony deposit. The arteria innominata was dilated to the size of a mould candle, and the right subclavian was as large as the little finger of an adult; the right carotid appeared natural. From within the opening of the innominata proceeded two aneurismal pouches; one turning to the right from the lower part of the artery, about the size of a chestnut; the other partly arising from the arch of the aorta, passing to the left, and as large as a hen's egg, pressing upon and opening into the trachea. Passing on in the course of the aorta, the left carotid was found to have no opening communicating with its parent trunk: a puckered depression alone marking the situation where it formerly existed; the artery, in other respects, though small, appeared healthy. Close to the origin and to the left of the left subclavian was a third aneurism the size of a walnut; the coagulum contained within which had so pressed upon the root of the subclavian, as completely to close its communication with the aorta. The artery itself was about the size of a goose-quill. All the aneurismal sacs contained a firm pale pink coagulum adherent to their parietes.

This case is interesting in many particulars. When first presented to my notice, I had little hesitation in putting it down as aneurism of the innominata, with diseased aorta; for though no impulse or bruit could be discovered at the upper part of the chest —which may, I conceive, be satisfactorily accounted for by the feeble contractile power of the heart—independently of the evident pulsation of the tumour itself, the dingy complexion so frequently observed in diseases of the primitive vessels, the increased sound of the heart in the track of the aorta, and the general symptoms, appeared sufficiently to characterise the complaint. The sudden disappearance of the tumour, however, seemed at first to throw some doubt upon the accuracy of this diagnosis; for though such swellings occasionally subside by a gradual process of natural cure, it is, I believe, rare for them suddenly to disperse, at least without the simultaneous appearance of severe and even dangerous symptoms. Two explanations occurred to me at the time; first, it was possible that no aneurism had ever existed, but that an abscess of the anterior mediastinum had been for some time formed:—that, from its increase in size, a portion of its contents had passed above the clavicle; and that it had there received an impulse from the large arteries upon which it rested;—that this abscess had burst into the right bronchus, a portion of its contents had been expectorated, and the subsidence of the tumour had been the result:—with this expla-

nation coincided the simultaneous increase and puriform character of the sputa. The other, and the more probable explanation was, that another and a larger sac had been formed in the course of the aorta; by the distention of which with blood, in consequence of the feeble state of the circulation, the smaller sac had been emptied, and had, in consequence, collapsed and contracted. This, I say, appeared the more probable explanation: but was again rendered doubtful by the streaks of blood in the expectoration, two or three days after; and still more so by the sudden expectoration of a large quantity of viscid sanguineous puriform mucus; which, though quite compatible with both views, was more consonant with that of abscess.—The perfect occlusion of the mouth of a large artery, though far from unprecedented in cases of aneurism, is by no means very common. An instance of the same kind in which the mouth of the same artery was very nearly closed, occurred, several years ago, in a woman operated on by Mr. Key for aneurism of the innominata. Since the occurrence of this, I have been informed, by a justly celebrated morbid anatomist, that a similar state of parts is not very unfrequent. The explanation of the circumstance is not, I think, very easy; and the only one I have heard advanced is the following: —The mouth of the artery is not dilated to an extent corresponding to that of the trunk from which it opens: when, therefore, a portion of the trunk yields, and a sac is formed, and the trunk itself consequently contracts, a puckering and narrowing of the mouth is produced, which favours if it does not cause its absolute occlusion. In the case related, however, the left sub-clavian, as well as the carotid, had been recently—though, I think, perfectly and permanently—closed; the consequence of which, had the man lived, would probably have been gangrene of the arm; as the carotid, from which it must have received its principal supply, was itself furnished with blood by anastomosis.

I have only to observe, in reference to the fibrinous concretions, that they belong to that variety which I have termed the Massive; and that I conceive there can be little doubt, from the circumstances I have mentioned, connected with them, that they were formed before death. Whether they were the cause or the consequence of the extremely distressing condition to which the poor man was reduced, in the last twenty-four hours of his existence, I am, of course, unable to determine: but, from the exceedingly feeble circulation, the great obstruction to the flow of blood, the consistence of the heart itself, and the sudden appearance of the aggravated severity of his symptoms, or, more properly, of the indications of approaching death, I have no hesitation in expressing my opinion, that they were really the cause of that condition.

The particulars of the only instance I have seen of the Parietal variety are related in the following case:—

Case 4.—A short stout man, aged 28, suffering from catarrh, was observed, about a week before his death, to have a very irre-

gular pulse—his countenance was slightly suffused and anxious—he complained of oppression at the scrobiculus cordis, and severe pain across the loins. There was not extensive dulness of the pericordial region; but the impulse of the heart was felt over a larger space than usual, and was considerably increased below the ensiform cartilage: the sounds were soft and indistinct. The day before his death he complained of severe pain in the præcordial region, and suffered from paroxysms of intense dyspnœa; during which he moaned piteously, and was purple in the face. During the intermissions of these paroxysms, he lay on his back, rather inclined to the right side; breathed freely, and filled his chest without distress; the face was pale, with a slight purple tinge. He expired in the evening, in one of the paroxysms. On examination after death the left pleura was found to contain about half a pint of clear serum—a little emphysema existed at the edges of the right lung—the bronchial membrane was generally inflamed, and the left bronchus flattened by compression—the pericardium was universally adherent by loose cellular membrane. The heart was enlarged; and between the muscular parietes and pericardium was a layer, varying from one and a half to two lines in thickness, of a reddish-yellow adipose substance. All the cavities of the organ were dilated; and the left ventricle was also hypertrophied. They were all filled with soft purple, easily separable coagula; but the left ventricle was also lined with a firm, yellow, fibrinous coating, which mingled with, and was slightly adherent to the columnæ carnæ; and composed of bands, which by their arrangement presented the general appearance of the interior of the ventricle: the mitral and aortic valves were thickened, and the aorta about one third less in size than the pulmonary artery.

Concretions belonging to the Globular variety are generally productive of few or no symptoms, and occur only in those who are moribund for a considerable time:—

Case 5.—A man aged about 50, with considerable deformity of the chest, suffered from dyspnœa and anasarca; but the exhausted state in which he lay for some days before his death prohibited any examination by auscultation. After death, the lungs were found very generally consolidated by pulmonary apoplexy; the heart was much dilated; and the cavities, particularly the right auricle and left ventricle, contained several cystiform coagula, the exterior of which was membranous and reticulated, and the interior soft and grumous; they were particularly abundant in the dilated apex of the ventricle, and adhered slightly to the lining membrane. Some of the natural depressions also of the heart were filled with small rounded masses of fibrin of the same general character.

Case 6.—A mountebank, aged 48, was admitted into the hospital, in an exceedingly feeble condition. He rallied a little by the use of stimulants, but afterwards sank from exhaustion. On examination, the heart was found to be slightly dilated; the left ventricle contained defined rounded coagula, of a light colour, soft and grumous

internally, and firmly attached to the surface; one of them was situated quite in the apex of the cavity.

Case 7.—An old man with disease of the chest lay for a long time before death in a sinking state; the lungs were found to be generally consolidated from gray hepatisation and tubercular deposit; the heart was dilated. After the recent coagulum had been removed from the right ventricle, a grumous lilac-coloured fluid was observed to escape from the apex; and was found to have proceeded from a round cystiform coagulum of the same colour, and about the size of a large marble, lodged in the extremity of the cavity.

Case 8.—A woman, aged 41, suffered from the ordinary symptoms of diseased heart, and considerable accumulation of fluid in the abdomen. She was tapped; had hæmoptysis, and was exceedingly exhausted, after the operation; and died in about a week. On examination, both pleuræ were found to contain a considerable quantity of serum; and in the lungs were several consolidated masses, the result of pulmonary apoplexy. The pericardium contained about half a pint of serum; and was much thickened, and opaque. The muscular structure of the heart was paler and firmer than natural, and between its fibres contained a dense white deposit, which gave it a mottled appearance: the lining membrane was mottled with white spots: the left ventricle was immensely dilated, being at least three times its ordinary size: the mitral and aortic valves were opaque and thickened, and the aorta itself was small: portions of fibrin, of a rounded form, adhered to the parietes, and were lodged in the depressions of the left ventricle; some of which were solid; others cystiform, and contained a thick dirty-white turbid fluid.

In the following case, the severe and sudden paroxysms of dyspnœa may possibly have been connected with the concretion found in the left auricle:—

Case 9.—A man, aged 42, had suffered for six years from symptoms of diseased heart, following rheumatism, to which he had been subject from childhood. A few days before his death he was attacked with paroxysms of fainting, cold perspiration, and severe dyspnœa, with feeling of imminent suffocation; during which his attendants thought him dying; but after which he regained his usual comparatively quiet condition. He was temporarily relieved by sinapisms and stimulants; but the fits afterwards returned with greater frequency and severity, and in one of them he threw himself out of his chair and expired on the floor. The lungs were not much diseased. The pericardium was universally adherent. Between it and the muscular parietes of the heart were several plates of cartilage, interspersed with specks of bone; and at other parts, a layer, half a line thick, of an opaque dense yellow substance. The heart was much dilated, and its cavities distended with soft purple coagula. The appendix of the left auricle was filled with a firm,

brownish concretion, which was adherent only at the very extremity, and presented a rounded projection towards the general cavity. A section presented a party coloured surface, not unlike some specimens of fungus; and exposed three or four irregular cavities, some of which were filled with a purple, and others with a cream coloured fluid. The mitral and aortic valves were very much ossified.

I am not acquainted with any symptoms by which concretions of long standing, resulting from inflammation, can be certainly distinguished from the more common diseases of the valves. But if, in the course of endocarditis, the natural sounds of the heart were suddenly decreased, and a soft bellows murmur, which had not previously existed, supplied their place, and there were indications of unusual obstruction to the circulation and consequent general distress, I should be induced to suspect their formation. I may also state, that, even in chronic cases, I have sometimes been enabled to predict their existence, if large or extensively deposited, by an unusual coldness and blueness of the nose and extremities supervening more quickly upon the original attack, and being more marked and decided than could be otherwise explained by the physical signs afforded by the heart, and by the abnormal sounds being less harsh and strong than in ordinary disease of the valves. I think this may be, perhaps, understood, when it is recollected that this condition of the valves is probably produced in a much shorter time than is required for extensive cartilaginous or ossific deposit in the parts affected; and, consequently, that the parietes of the ventricle have not become thickened, nor the vessels dilated, to a degree proportionable to the amount of obstruction, as in diseases of slower progress and longer duration. Of the two following cases, the former illustrates the history of amorphous concretions; and the latter is introduced for the purpose of supporting the statements I have made in reference to the symptoms resulting from warty concretions.

Case 10.—A thin, delicate girl, aged 17, came under my notice, as a patient of the late Dr. Cholmeley, in Guy's Hospital; when her face was pale; her feet, hands, and nose cold, and of a purplish leaden hue. The respiration was not particularly laborious, though very frequent—46 in the minute. Dyspnœa and palpitation occurred on the slightest exertion or excitement; and she was unable to lie down in her bed, or to turn on the right side. She had much soreness, on motion, at the scrobiculus cordis, and tenderness on pressure there, in the intercostal spaces of the præcordial region, and over the inferior part of the right side of the chest. The tongue was clean and moist; the bowels open, without medicine; the urine scanty; and there existed slight œdema of the feet: the pulse was 120, small, and very feeble; and the skin, except at the parts previously mentioned, warm and dry. The resonance of the chest, generally, was tolerably good; but considerable dulness on

percussion, existed over the inferior part of the right side. Here, also, the respiration, which at other parts was tolerably natural, was deficient, and accompanied by a sibilous rattle; and there existed increased resonance, and unnatural shrillness of the voice. The impulse of the heart was feeble; the rhythm natural; the first sound was clear, but not loud; the second was indistinct.—She was ordered stimulant diuretics, and small doses of mercury; and to be cupped to four ounces, in the region of the heart. She was much relieved by the cupping; which was performed two days after her admission, and was succeeded by a blister. For about ten days she was much better; was able to lie down in her bed; and was but rarely attacked with paroxysms of dyspnœa. After the expiration of that time she became troubled with a feeling of suffocation, which prevented sleep and recumbency; and though she could then turn to either side, the tenderness in the left reappeared; the skin was hot; the impulse of the heart stronger, and jerking; the pulse frequent, and weak; and the extremities were still cold. She was again cupped, with relief; and afterwards ordered digitalis, but was soon after removed by her friends. During the three weeks she afterwards lived, I saw her only occasionally; but I am not aware that any fresh symptoms appeared, excepting that evidence of effusion in the right pleura became more decided, and that her back became sore from lying in bed. It is remarkable, that while she was capable of bearing an examination of the chest no morbid sounds were observed in the heart during the whole of her illness.

The body was examined by Dr. Barlow; who favoured me with a view of the heart, and some of the following particulars:—Chest: on both sides, the pleura were partially united by old cellular adhesions, and by some recently effused plastic lymph; and on both, but particularly on the right side, there was a considerable quantity of serum. The lungs were healthy. The pericardium was universally adherent, through the medium of firm solid lymph, which allowed of the easy separation of the two folds of the membrane. The heart was of natural size; and its muscular walls not much changed, but rather pale and flabby. The lining membrane was thick, rough, opaque, and injected; and attached to it, in both the auricles, and ventricles, particularly on the left side, were flat irregularly-shaped masses of firm opaque fibrin, some of them of considerable size. They were particularly abundant among the tendons of the auriculo-ventricular valve. To the mitral was attached a portion, of the shape and size of the first joint of the little finger, which projected into the ventricle; and which, like most of the other masses, was fairly adherent to the lining membrane itself, and possessed many of the physical characters of muscular fibre. With the exceptions already mentioned, the valves on the right side appeared pretty healthy; those of the aorta were slightly thickened and opaque; the mitral was thickened, contracted, and corrugated near its free margin, but yet appeared large enough to close the opening to which it was attached, which would scarcely allow of

the passage of the little finger. The aorta was exceedingly small, but not diseased.

Case 11.—A large and muscular woman, aged 25, after two attacks of rheumatism, was troubled with dyspnœa and palpitation on exertion or excitement. When she was admitted into Guy's Hospital, independently of the general symptoms of diseased heart, the extremities were cool; the lips and tip of the nose purple and cold; the respiration was laborious, and the pulse scarcely perceptible; the resonance of the chest on percussion generally deficient, but there was no unusual dulness of the præcordial region. The impulse of the heart was rather great, the rhythm natural, and the sounds indistinct; the first being followed by a soft bellows murmur. She died suddenly on the following morning.—On examination, the pleuræ were found adherent, and the lungs much congested, and interspersed with consolidated masses from pulmonary apoplexy. The pericardium was healthy. The heart was rather larger than natural; the right ventricle being rather dilated, and the left slightly hypertrophied. The pulmonary and tricuspid valve were rather thickened; and upon the upper surface of the latter were some warty concretions. The mitral valve was thick, rigid, and contracted; and the aortic valves were opaque, and less flexible than natural. Upon all of these, attached to the surface opposed to the direct current of the blood, were scattered warty concretions; some with a smooth, others with an uneven surface, varying in consistence from that of boiled albumen to fibro-cartilage. Some were not merely soft, but friable; and composed of small granules, of a dead-white and tawny colour; one of these, as large as half an almond, appeared to be covered with a membrane, and depended from one of the aortic valves into the ventricle. The aorta itself was not healthy.

Of the treatment very little need be said; as it is obvious that, in the forms of concretion dependent on retardation, when the symptoms are decided in their character, little can be effected by medicine; and that sinapisms externally and stimulants internally, are the remedies imperatively demanded by the condition of the patient. Should any amount of reaction occur, it may become a question if a small abstraction of blood may not be desirable; and whether, together with stimulants, the salts of potass and soda may be advantageously administered; as, according to Magendie and others, they not only possess the power of dissolving fibrin, but of decreasing its coagulability. Dupuytren is stated to have caused the absorption of coagula in aneurismal sacs, by the internal and external use of acetate of lead. Should this be confirmed by the experience of others, it might possibly be employed with benefit in the cases now under consideration.

In the inflammatory species, the remedies adapted to the cure of endocarditis, particularly the free but careful employment of mercury, are clearly indicated as long as any evidence of inflammatory action exists. When it has been subdued, it is doubtful if much can

be effected to produce absorption or solution; but mercury should still be carefully administered; and liq. potass. or the salts of potass and soda, may certainly here be prescribed, not only with safety, but advantage; as, if they have no effect in dissolving the fibrin already coagulated, or in preventing its further coagulation, they will act beneficially, by increasing the secretion of urine, which is generally deficient, and removing disorders of the stomach which are commonly present in all diseases of the heart.

Note.—Since this paper has been to the press, I have seen in the Medical Gazette of March 9th, a brief account of some experiments made by Mr. Gulliver, which amply confirm the opinion I have expressed above. Justice, however, demands that I should state, that Dr. Addison has for some years strongly insisted upon this softening of fibrin giving rise to the puriform fluid found in the veins of persons affected with phlegmasia dolens; and that Dr. George Burrows, in his Croonian Lectures, published in the 15th volume of the Medical Gazette, mentions some experiments which he had made, and which he adduced in support of his opinions.

them for the performance of the functions of nutrition and reproduction, otherwise than to supply, by its locomotive actions, the conditions of those functions would appear from what has been already stated.

6. If these phenomena do not constitute any evidence for the existence of a nervous system in such beings, it may be reasonably enquired what ground we have for placing them in the animal kingdom. All our reason for attributing to them *sensibility* is derived from the movements which they execute in respondence to external stimuli; but such movements are also executed by the dionæa and sensitive plant. But some of their actions appear to show a certain degree of voluntary power, and therefore of consciousness; being independent, so far as can be ascertained, of the operation of external stimuli. Moreover, we often see an impression made upon one part (one of the tentacula of the hydra, for example,) propagated to distant parts, and exciting respondent movements in them, more rapidly than we could imagine to occur without such a channel of communication as a nervous system *only* is known to afford. These phenomena, then, would lead us to suspect the existence of a nervous system in beings that exhibit them; *not*, however, in a diffused condition, but in the form of connected filaments. For what consentaneousness of action can be looked for in a being whose nervous matter is incorporated in the state of isolated globules with its tissues? How should an impression made on one part be propagated by these to a distance? And how can that consciousness and will, which are one in each individual, exist in so many unconnected particles? The essential character of a nervous system is its capability of conducting excitor and sensory impressions *to* a centre, and motor impulses *from* it; and this cannot be effected by any such structure as the one imagined to exist in these beings. As well might we say that a "diffused" circulating system exists, where every part of the tissues is in equal contact with the surrounding medium, and equally performs the functions of absorption, assimilation, and excretion.

7. If, then, we allow any sensibility, consciousness, and voluntary power to the beings of this group—to deny which would be in effect to exclude them from the animal kingdom—we must regard these faculties as associated with *nervous filaments* of such delicacy as to elude our means of research; and, when the general softness of their textures, and the laxity of structure which characterises the nervous filaments in the lowest animals in which they *can* be traced,[1] are kept in view, little difficulty need be felt in accounting for their

[1] Thus in the conchiferous mollusca, the sheaths of the nerves are so loose and the filaments they enclose have so little tenacity, that they were mistaken by Poli for lymphatic vessels, and the ganglia for receptacula chyli. Having been injected by him with mercury, they were beautifully figured under this character in his splendid work, Testacea utriusque Siciliæ.

apparent absence.[1] The case is very different from that of plants, in which the negative evidence afforded by anatomical research is far more to be relied on.

8. The only animal among the polypifera in which a nervous system has been stated to exist, is the common *actinia*, or sea-anemone. A description of a series of ganglia and diverging filaments, connected with the muscular base, was given by Spix;[2] but it is now generally agreed by competent observers, who have searched for it in vain, that the account is erroneous, and that no nervous filaments can be detected in that situation. Very considerable muscular power is exercised, however, by the tentacula and muscular integument of the sea-anemone; and *that* with a consentaneousness which strongly indicates the combining or *internuncial* power of a nervous system. From the analogy of the radiated classes, to which this animal approaches, we should be rather led to search for nervous structure around the entrance to the digestive cavity; and professor Jones[3] has recently described a delicate filament which he suspects to be of this character, running round the roots of the tentacula, and imbedded in a strong circular band of muscle, which surrounds the orifice of the stomach, and acts the part of a powerful sphincter in closing the aperture.

9. There has been much vagueness in the comparisons frequently drawn between the springs of action in these creatures, and the agents which operate in higher animals. And this may be attributed to the tendency which is prevalent among many physiologists to grasp at a superficial resemblance, instead of seeking for a more fundamental analogy. Thus, some naturalists seem by their language to imply that the little *hydra viridis*, or green polype, possesses as much sensibility and is as completely under the guidance of volition, as man himself. But what is the character of this interesting little being? It is *a stomach*, the orifice of which is provided with tentacula, that contract when irritated by the touch of any adjacent body, and endeavour to draw it towards the entrance. To what action in the human body is this most allied? Evidently to that of the muscles of deglutition, over which we know, that *will* has no power, and whose actions probably do not even involve sensation, being of a simple *reflex* character. These like the tentacula of the hydra, contract upon whatever is brought within their sphere, and convey it to the orifice of the stomach; the only difference is that, in man and the higher

[1] An interesting fact has lately been communicated to the author by his friend Mr. Edward Forbes, in regard to this question. Having collected a number of specimens of *cydippe* (Beroe) *pileus*,—an animal in which a nervous ring has been stated by some to exist, and by others to be absent,—he was led to remark that extremely slight variations in the transparency of the individuals, and in the light in which they were viewed, would occasion the presence or absence of the filaments to be decided on by the observer.

[2] Annales du Muséum, tom. xiii.

[3] Op. cit. p. 43.

animals, another set of muscles is superadded to these, in order to prepare the aliment for the operations of the stomach and to bring it *within reach* of the pharyngeal constriction. But it may be urged, does not the inactivity of the tentacula, when the hydra is gorged with food, prove that they are excited to action by the will of the animal? We think not; and for these reasons:—The cavity of the stomach is evidently continued into the arms; and it is evident that, when the former is distended, the tissues of the latter also will be gorged with fluid. It is easy to imagine that this condition may be unfavourable to the exercise of their contractility; just as the distention of the tissues of a plant, by any check offered to the function of exhalation, speedily suspends their absorbent action. But we have a still more satisfactory explanation in the fact, that the muscles of deglutition in man are not called into action nearly so readily and energetically when the stomach is distended, as when it is empty—a fact of which any one may convince himself by observing the relative facility of swallowing at the commencement and termination of a full meal. No one will assert that *this* variation is an effect of the will: indeed, it is often opposed to it, being one of those beautiful adaptations by which the welfare of the economy is provided for, but which the indulgence of the sensual appetites opposes. Most of the movements of this animal, and of others of the class, appear to be equally the result of external stimuli with that already described; and it is only in a few instances, principally those of absolute locomotion or change of place, that any evidence of voluntary action can be discerned. There is no doubt that many of these movements are influenced by light; but it may be questioned whether the animal is conscious of its presence *as light*, or whether it may not be acted on by this stimulus somewhat in the same manner as plants are known to be, which grow towards it.

III. NERVOUS SYSTEM IN THE RADIATA.

10. The general characteristic of the radiated classes is the repetition of similar parts round a centre, which is the place of the mouth or entrance to the digestive cavity. In many of the species included in the group, however, this repetition is but obscurely traced; it is by these that the transition is effected to other classes. Wherever a nervous system has been traced, it has been found to partake of this character, presenting the form of a ring surrounding the mouth, and sending off filaments to each of the segments of the body.

11. The peculiar softness of the tissues of the animals composing the class acalephæ, renders the detection of a nervous system in them a matter of some difficulty and uncertainty.[1] No continuous

[1] A *medusa*, which, when taken out of the water, weighs fifty ounces, is reduced by drying to a few grains.

filaments have as yet been certainly traced in the larger *medusæ*, where the locomotive powers of the structure would lead us to suspect their existence. Ehrenberg, however, has recently described two nervous circles in their disks—one running along the margin of the mantle, and furnished with eight minute ganglia, from which filaments proceed to the eight red spots which he supposes to be eyes; whilst the other is disposed around the entrance to the stomach, and furnished with four ganglia, from which filaments proceed to the four tentacula. In the little Beroe, (*cydippe pileus*,) however, the nervous system can be seen without dissection, though not always with certainty (§ 7, *Note ;*) and it presents the form of a double ring around the mouth, with eight minute ganglionic enlargements, from which filaments diverge to the spaces between the longitudinal ciliated bands.[1]

12. In the echinodermata, we shall find the same type of structure manifested with little variation. We may first enquire, however, into the character of the sensory and locomotive powers which the animals of this class possess. Their movements are of various kinds. Change of place is principally effected by the extension and contraction of the tubes which are protruded from the apertures in their covering. These tubes possess a fibrous contractile structure, by which they are shortened when occasion requires; and their protrusion is effected by projection of fluid into them from cavities within the body. By means of suckers at their extremities, the animal fixes upon some firm surface those which it has advanced; and then, by contracting them, draws itself forwards. It may perhaps be doubted how far this *contraction* of the tubes is effected by any stimulus communicated from the nervous system, or whether it is not rather the effect of the elasticity of the tissue coming into play when the distending force is withdrawn; just as the claws of the feline tribe are retracted by their elastic ligament, when the protruding muscle ceases to act. We can hardly avoid the belief, however, that the internal reservoirs of fluid must be influenced by the nervous system in order to produce that *consentaneousness* of action which is essential to the regular movements of the animal.

13. Besides these instruments of locomotion, the *asterias* seems to possess the power of altering the form of its whole body, by bending its rays towards either surface, or approximating them laterally, by which it can adapt itself to the passages through which it is creeping, and even assist in drawing its prey towards the mouth. This seems effected by muscular fibres, running both longitudinally and transversely along the rays. The *holothuria* has a muscular system of the same kind, but much more developed, by which the general cavity of the body may be dilated or contracted, and by its means change of place seems to be partly effected, as well as the regular inspiration and expiration of water, which is performed at definite intervals. The stem and branches of ther amifying respira-

[1] Grant, in Trans. of Zool. Soc., vol. i.

tory apparatus itself are also provided with muscular structure, and contract when irritated; they are even able to carry on the respiratory movements to a certain degree after the sac has been cut open.[1] The tegumentary covering of the *holothuridæ* is particularly susceptible of irritation from external objects—the slightest touch often causing powerful contraction. We can scarcely regard either this or the respiratory movements as of a *voluntary* character; they would rather seem to be the result of a simple reflex action; and it is a curious evidence of their being but little subject to the control of the will, that the contraction is often so powerful as to rupture the membrane of the cloaca, and to force large portions of the intestine through the aperture. The density of the integument in the *echinus* altogether prevents any such movements of contraction and expansion; and the respiratory currents in it, as in the *asterias*, are produced by the vibration of the cilia which cover the membrane lining the shell and the other aerating surfaces. But in this animal there is another series of movements (besides that of the spines), no less remarkable—those of the dental apparatus—by which it is enabled to break down the firm calcareous shells of the crustacea on which it feeds, and other bodies of equal density.

14. The echinodermata have not been usually regarded as possessing any other sense than that of touch, which seems to reside in their extensile feet, and especially in those modifications of them which are placed round the mouth, and serve especially as *tentacula*. Ehrenberg, however, is disposed to regard certain red spots, at the extremity of the rays, as rudimentary organs of vision; and he states that the nervous trunk is continued towards each, and swells into a sort of ganglion, where connected with it. The recent observations of Mr. E. Forbes seem to confirm this belief—that gentleman having pointed out a curious disposition of the spines round these spots, by which they can completely fold over and protect them; whilst he has also remarked that the animal seems by their means to take cognisance of objects of food at a little distance from them. It may be doubted, however, whether a distinct visual perception is produced through their instrumentality; or whether the impression thus excited is not rather of a more general character, analogous to that formed by the organ of smell. It may further be doubted whether the contraction of the tubular feet, in respondence to external irritation, necessarily involves *sensation*. Considering these organs as analogous in function and character with the fly-trap of the dionæa, or the tentacula of the hydra, on the one hand, and (so far as the prehension of food is concerned) with the muscles of deglutition in the higher animals, on the other, we should rather incline to a negative opinion.

15. The nervous system of the echinodermata appears to consist essentially of a filamentous ring surrounding the mouth, which presents ganglionic enlargements equal in number to that of the seg-

[1] Cycl. of Anat., vol. ii., p. 41.

ments of the body; and from these diverge the filaments which connect this central apparatus with distant organs. In the *asterias* this ring may be distinctly traced; and from each of its ganglia a large branch is transmitted to the corresponding ray, whilst two smaller ones pass downwards to be distributed to the stomach and other viscera included in the centre of the star. A similar ring is stated by Dr. Grant, (and more recently by M. Van Beneden,) to exist in the *echinus*, which sends filaments to the dental apparatus, and others along the course of the vessels to the digestive cavity. According to Dr. Grant, also, a similar ring exists in the *holothuria*, which sends nerves to the mouth and the surrounding tentacula; others to the stomach and alimentary viscera; and others, again to the muscular bands, which form part of the tegumentary apparatus. In the *siponculus*, an animal which approaches the vermiform tribes in the aspect of its elongated body, though it still retains the essential characteristics of the echinodermata, we observe two of the longitudinal filaments more developed than the rest; and these are situated on what may be termed the ventral surface of the animal, so as to indicate a transition to the double nervous cord of the articulata.

16. In this nervous apparatus then it is evident that several distinct functions are combined. The nerves, which, from their distribution on the viscera, we should regard as analogous to the sympathetic of higher animals are not isolated at their central termination from those which appear connected with the sensorial and locomotive functions. Nor are those which minister to the instinctive actions separable from those which convey the influence of the will. It is important to observe that, in the typical members of the group at least, every segment of the body is equal in its character and endowments, and that each has a ganglion appropriated to it. None of these ganglia are different from the rest, and neither, therefore, can be regarded as having any *presiding* character.

17. All the movements which take place in respondence to external[1] impressions may, therefore, be regarded with probability as originating in the ganglion of the segment upon which the impression is made, and as propagated to the rest by the connecting filaments which form the ring. These movements, it can scarcely be doubted, constitute by far the greater part of those which the animals exhibit; and the purely instinctive character of almost all the operations which they are known to perform, together with this remarkable equal subdivision of their centres, may well leave us in doubt how far they can be regarded as possessed of any thing like our reasoning powers, or as actuated by the *voluntary* impulses

[1] The term *external* is here employed in the usual metaphysical sense, to imply that which does not originate in the *mind*. The impression may arise from some state of the corporeal structure itself, such as that which occasions in man the sensation of hunger.

which result from their exercise. It is remarkable, too, that all the ganglia should participate equally (as they appear to do) in the *special* sensation of sight.

18. We shall have some ground, then, for assuming in our future enquiries, that whenever a nervous cord terminates in a ganglion,[1] that ganglion may be regarded as the centre of the functions it performs; receiving the impressions made upon it, and exciting respondent motions without any exercise of the will being necessarily concerned. We shall hereafter find, however, that this is seldom the case to its full extent; but that where a ganglion is situated upon a nervous cord, *part* only of its filaments usually enter the mass, whilst a portion of them pass over or alongside of it, towards some other ganglionic mass, which seems to have a presiding influence over the rest.

IV. NERVOUS SYSTEM OF THE MOLLUSCA.

19. Feeble as are the animal powers in a great proportion of the molluscous tribes, they would seem to be almost extinct among the members of the class tunicata or *acephala nuda*. No beings possessed of a complex internal structure, a distinct stomach and alimentary tube, a pulsating heart, and ramifying vascular apparatus, with branchial appendages for aerating the blood, and highly developed secretory and reproductive organs, can be imagined to spend the period of their existence in a mode more completely vegetative than these. The greater number of them pass the whole of their lives in one situation, attached by a pedunculate prolongation of their external tunic to submarine rocks; many of the inferior species associate together like the polypifera (the higher tribes of which they much resemble,) to form a compound structure, in which several animals are more or less closely united: and those which are not attached to fixed points have little independent locomotive power but are driven about at the mercy of the waves.

20. These animals are enveloped in a tough elastic tunic (the analogue of the *valves* of the conchifera;) and within this is found a muscular coat, consisting of fibres crossing each other in various directions, by which compression may be exercised on the contents of the cavity it surrounds. Two openings penetrate these sacs; one termed the *branchial*, admits water to the general cavity, partly for the purpose of aerating the blood, and partly to bring food to the digestive orifice; the other, termed the *anal*, gives exit to the

[1] It is necessary, however, to limit the nature of the structure to which the term *ganglion* is here applied. It is intended to include those of the *symmetrical* system of the invertebrata, and the brain and spinal cord of vertebrata, which, as will be hereafter shown, (§ 44, and 76 8,) correspond in the relation of the white and gray matter they contain. The *intervertebral* ganglia of the spinal nerves, and those of the *sympathetic* system, have a very different structure, (§ 45,) and probably also perform functions of an entirely distinct character.

current which has passed over the respiratory surface, and also to the contents of the intestine and ovaria. These openings are bounded by distinct circular sphincters, with which radiating muscular filaments are intermixed, that extend in longitudinal bands over the surface of the sac.

21. By means of this apparatus, the animal is capable of diminishing the capacity of the branchial sac, and thus of ejecting, with considerable force, a part of the water it contains; whilst the elasticity of the external tunic spontaneously restores its usual dimensions when the contracting power is inactive. No movements of this kind, however, are commonly employed, either for the respiratory process, or for the prehension of food. A continuous and equable current of fluid enters the branchial orifice, and is propelled by the anal, without any other visible physical agency than the movement of the cilia which cover the aerating surfaces. The mouth, or entrance to the stomach, is situated at the bottom of the branchial sac, and is unprovided with any special sensory apparatus; it seems to derive its supplies from the respiratory current alone, and not to depend upon any prehensile movements: but particles unfit to enter it are probably stopped at the branchial orifice, (§ 24.) Moreover as each animal possesses within itself all the organs necessary for the propagation of its race, and as these appear contrived simply for the passive evolution of germs, no powers of active motion are called into exercise by the performance of this function.

22. So far as the regular vital operations are concerned, therefore we see no indication of *voluntary* actions in these animals or even of that kind of respondence to impressions, which would lead us to suspect the existence of a connected nervous system. But, in the simultaneous contraction of the whole muscular sac which is occasionally witnessed, we can scarcely fail to acknowledge the operation of nervous agency. If one of these animals be touched, when its cavity is full of water, a jet of fluid is thrown out to some distance; and sometimes a number "are so closely impacted together on the rocks, that the impression given to one causes it suddenly to retract, which also acts on the one next to it, and so on throughout several of them, and each in contracting throws out a quantity of water."[1]

23. We find, accordingly, on examining into the character of the nervous system, that it is most simple in its structure and distribution. We have here no repetition of parts as in the radiata, and one ganglion serves as the centre of all the actions to which this system ministers. This ganglion lies between the two orifices, and sends filaments towards each, as well as others that ramify upon the muscular sac, to which they seem almost exclusively confined. In fig. 2, are seen the position of the ganglion, and the distribution of its filaments in *ascidia mammillata*.[2] The nervous

[1] Grant's Lectures on Comp. Anat. xxxii.
[2] Cuvier, Mem. sur les Mollusques.

filaments which pass to the branchial orifice diverge to enclose it, and meet again beyond, so as to form a complete ring; and sometimes, according to Dr. Grant, a small ganglion is found at the point of their reunion. Some small ganglia have been described by Meckel and others, as occurring among the viscera; but their presence is, with much reason, doubted by Mr. Garner.[1] If such should be proved to exist, it is manifest that they are to be regarded as rudiments of a sympathetic system; which does not, however, manifest itself in so distinct a form in any of the lower molluscous classes.

24. The only organs of special sensation that this animal can be regarded as possessing, are the tentacular filaments which fringe the interior of the branchial orifice. Although nothing is absolutely known of their function, it would not seem improbable that they are susceptible of impressions from substances entering with the respiratory current; which being propagated to the ganglion, may excite the closure of the sphincter, by means of the motor nerves, and thus prevent the admission of injurious bodies. Should this be the case, we can hardly regard the action as of more than a *sympathetic* character, since the closure of the sphincters in the higher animals is, in like manner, independent of the impulse of volition, although capable of being influenced by it. It would seem probable, too, that by the same sphincter is regulated the quantity of water which shall enter for the supply of the respiratory and digestive systems, in accordance with their requirements, communicated in like manner through the ganglion; and the ciliary movements would appear to be under the same control, (although not so in higher animals,) since, in those beings which make use of them for the acquirement of food, such as the common wheel-animalcule, they stop and recommence in such a manner as to prevent the observer from assigning any other cause to their variations.

25. We next pass on to the conchifera, or *acephala testacea*, a class which, though somewhat higher in the scale than that just described, has a very close affinity with it. Instead of an elastic external tunic, we find a calcareous structure enveloping the body, formed of two valves united by a ligament, and by one or two adductor muscles. In this case, as in the former one, the elasticity of the ligament maintains the natural expanded state of the cavity of the shell; whilst the contraction of the adductor muscle, which is evidently under the control of nervous influence, draws the edges of the valves in close apposition to each other when the animal is threatened with injury. The mantle which forms the cavity that contains the viscera, is less muscular than in the tunicata; and the respiratory current is maintained through its branchial and anal orifices, just as in that class, without any other apparent means of propulsion than the vibration of cilia. Sometimes these orifices are prolonged into tubes or siphons; whilst, in a great proportion of the

[1] Loc. cit.

class, the cavity of the mantle is left entirely open, by the incomplete adhesion of its lobes along the margin of the shell.

26. A good deal of variety exists among the members of this class in regard to the developement of the locomotive and sensorial powers. In some of the lowest, neither would seem to be much exalted above those possessed by the tunicata. The *oyster*, for example, attaches itself to rocks by calcareous exudation from the secreting surface of the mantle, and passes the term of its existence in a state of inactivity which is only interrupted by the occasional closure of its shell. It is entirely dependent upon the motion of the surrounding element for its supplies of food; and, as its digestive cavities are found to contain only small particles of vegetable matter, it does not require for the prehension of its aliment any complex apparatus in which active movement is essential. Here, too, each individual possesses the entire reproductive apparatus within itself; and even if, as has been recently maintained, the proximity of two individuals is requisite for the fertilisation of the ova, it is quite certain that no change of place is involved in the function.

27. A somewhat greater advance, however, is witnessed in the sensory apparatus. Late observers state that distinct, though slightly developed organs of vision may be detected at the margin of the mantle.[1] These, no doubt, may serve to indicate to the animal the approach of danger, and cause it to employ its only means of defence,—the closure of its shell,—an action evidently analogous with the contraction of the enveloping muscle of the tunicata. This accounts for the fact known to fishermen, that the shadow of a boat passing over a bed of oysters, causes the animals beneath to close their shells. An important change also here takes place in the position of the sensitive tentacula which guard the entrance to the alimentary canal. These are now developed from the true mouth, which still remains within the cavity of the mantle; and the orifices of this cavity are almost destitute of them, even when prolonged into siphons. Where the cavity is left open, it is obvious that there is nothing to prevent foreign substances from immediate contact with the mouth, although the margins of the mantle still appear possessed of greater sensibility than its other parts. The two pairs of long flexible tentacula or palps, with which the mouth is furnished, seem designed to guard its orifice, by causing its closure against substances unfit to enter it, rather than to convey nutritious particles to the entrance of the tube, which is sufficiently accomplished by the respiratory current.

28. In the nervous system of the oyster, we find but a slight advance upon that of the tunicata; and this has reference more to the increased importance of the sensory organs, than to the development of locomotive powers. The principal ganglion (B, Fig. 3) is situated by the adductor muscle, between the branchiæ, and hence

[1] Garner, loc. cit.

may be called the *posterior* ganglion.[1] It obviously corresponds, both in situation and in its relation to the respiratory organs, with the single ganglion of the ascidia; though part of the functions of the latter are here performed by a seperate centre. It sends branches to the mantle (*a*), others to the branchiæ (*b*), small twigs to the adductor muscle (*c*), and two trunks (*d*, *d*,), which connect it with the *anterior* ganglia (A, A). These ganglia are very small in the oyster, and are situated considerably below the entrance to the œsophagus (ε): they are united by a transverse filament (*e*), which passes under that tube, but they also send forwards a large branch (*f*), which arches over the mouth. The principal branches from these ganglia, besides the connecting trunks, are distributed upon the tentacula and the anterior portion of the mantle. These anterior ganglia being alone connected with the special sensory organs, will obviously have a superior influence on the movements of the animal; but as they are not immediately connected with the adductor muscle, it is obvious that whatever motor impulse may result from irritation of the tentacula, must be propagated along the cords which pass to the posterior ganglia. On the other hand, the posterior ganglion may be considered, from its size and connections, as the centre of the actions performed by the organs which it supplies, when these are stimulated by impressions made on or originating in themselves. Such would probably be the case with respect to the respiratory movements, to direct which would seem to be the special function of this ganglion. Besides the branches which have been mentioned as proceeding from it, there are some minute filaments sent by it to the viscera; and it would thus seem, like the ganglia of the asterias, to unite the offices of both systems which are seperate in the higher animals.

29. The whole course of the lives of these animals shows them to be so little elevated in the scale of psychical endowment, that we can scarcely regard the motions executed by them as often possessing a voluntary character; they may rather be compared with the involuntary or sympathetic actions of the higher classes;—the closure of the shell, for example, resembling in its *protective* tendency the contraction of the pupil under the stimulus of light, or the closure of the glottis against irritating matters. It may not, perhaps, be a departure from rigid analogy to suppose that, whilst the movements connected with their vital operations result, like those having a similar *immediate* connection in the higher animals, from changes in the nervous system, in which *mind*, in its restricted sense, cannot be said to participate, these animals may experience a sense of enjoyment or well-being, arising from the fulfilment of these operations, corresponding with that which man experiences during the digestion of a sufficient but not excessive meal, and relatively higher in degree, because not subordinated to others.

30. In the higher species of this class, we find a peculiar loco-

[1] Garner, loc. cit.

motive organ developed, which serves a variety of important purposes. This organ, which is termed the *foot*, has a firm muscular structure, and is capable of very energetic action. Sometimes it is employed in burrowing in sand or mud; and sometimes in executing sudden and rapid motions—true leaps—by which the animal is enabled to change its place with great celerity. These motions are frequently executed in such a manner as to imply consciousness of the most advantageous direction for them, and therefore the operation of a guiding *will*. A curious instance of this kind has been elsewhere mentioned by the author;[1] and he has since learned that it is no uncommon thing to see animals of this kind making their way along the sea-shore in the most direct line towards the water, as if conscious of its proximity. The foot is largest and strongest in the most active species, which never form any local attachment; but, in others, its principal function seems to be to form the *byssus* which attaches them to rocks, and it is then reduced to a rudimentary condition.

31. Wherever the *foot* exists in the conchifera, we find an additional ganglion in close relation with it, being usually situated at its base, and following its changes of position, as well as corresponding with it in degree of development. As the nerves proceeding from it, with the exception of the trunks that connect it with the anterior ganglia, are almost entirely distributed on this organ, it may with propriety be called the *pedal* ganglion; or, from its position, the *inferior*. Of this we shall see a good example in the *pecten* (Fig. 4). Here the anterior and posterior ganglia have pretty nearly the same relation as in the oyster, except that the latter have partially separated, so as to form a bilobed mass, which, in other instances (*modiola*), becomes completely double. The anterior ganglia, however, are much larger in proportion; and, besides transmitting the usual branches to the posterior ganglia, they are connected by two considerable trunks with the pedal ganglion (c).

32. In considering the relative functions of these ganglia, it is important to remark that, whilst the *pedal* or inferior ganglion, and the *posterior* single or double ganglion, are always connected with the *anterior* ganglia, they are never immediately connected with each other. This would seem to indicate that their functions are distinct, though partly dependent on the influence of the anterior ganglia. With regard to the *posterior*, it has already been stated to be principally connected with the *respiratory* apparatus; and all the reflex actions of the parts which it supplies are probably effected by its instrumentality alone. The influence of the *pedal* ganglion over the foot is probably of a similar character. The general movements of the organ may be directed by the cephalic ganglia; whilst the particular actions by which it fixes itself upon a given surface, and adapts its disk to the inequalities which it encounters,

[1] Principles of Gen. and Comp. Physiology, p. 99.

may be produced simply by impressions reflected through this ganglion by its afferent and efferent nerves. Although such a view must be admitted to be hypothetical only, as regards this class of animals, it will be hereafter seen to derive remarkable confirmation from the actions of the suckers of the cephalopoda in relation to their ganglia (§ 66, 67), and from similar experiments on the independent functions of the pedal ganglia in insects and other articulata (§ 80.)

33. The cephalic ganglia, although still beneath the œsophagus, must be regarded as having a presiding influence over the others, being the residence of whatever sensibility to impressions of a *special* kind these animals may possess, and therefore, in all probability, the instruments of their psychical operations. Their immediate connection with both of the other divisions of the nervous system evidently favours this idea; and any actions which result from visual impressions, or from irritation of the tentacula, may, therefore, be regarded as originating in them. In this point of view, whilst the anterior ganglia may be compared with the upper part of the cerebro-spinal axis in vertebrata, the branchial ganglia would be analogous to the medulla oblongata,[1] which is the recipient of impressions and the originater of motions connected with the respiratory function: and the pedal ganglion would be regarded as corresponding with one of the ganglia in the double column of the articulata, and therefore (as will hereafter appear, § 79) with *one segment* of the spinal cord in vertebrata.

34. In some of the highest species of this class, as *mactra*, which show more activity than the rest, the cephalic ganglia are actually anterior to the mouth, and nearly meet over it, as shown in Fig. 5.

35. In the next class of mollusca, the gasteropoda, we recognise a type of the nervous system essentially the same with that just described, but modified to correspond with the conditions in which the animals are formed to exist, and especially with the changes in the situation and developement of their locomotive and sensory organs. Although none of this class possess very active powers of locomotion, few are entirely fixed; all are more or less dependent upon the exercise of these powers for their supply of food; and the higher tribes employ them also in the perpetuation of the race, since the connection of two individuals is in them an essential part of this function. Among the testaceous species, locomotion is principally effected by the alternate expansions and contractions of the fleshy disk termed the foot; by which the animal is enabled to crawl slowly along solid substances, whether on land or in water, with a slow but equable progression. In some of the aquatic species, this disc is convertible into a kind of boat, by the buoyancy of

[1] It will presently be seen that the *distance* of the branchial from the cephalic ganglia in the cases hitherto mentioned is no obstacle to this analogy; the position of the former being entirely regulated by that of the gills.

which the animal can suspend itself in an inverted position at the surface of the water, and then employ its tentacula and mantle as instruments of progression. Some of the naked aquatic species are still more active, moving through the water by the undulation of their whole bodies, like the leech or the vermiform fishes; and some appear materially assisted by an expansion of the mantle on the anterior part of the body, which contains muscular fibres, and probably acts as a fin. Besides these motions, all the testaceous species have others by which the place of the body is changed in reference to the shell; special muscles (obviously analogous to the *adductors* of the conchifera) being provided, by which the parts that are occasionally protruded can be immediately retracted within it.[1]

36. In every division of the animal kingdom, we find the developement of special sensory organs to bear a close relation with that of the locomotive apparatus. In the present instance, we observe an evident example of this general fact. The organs of vision, which, when existing at all among the conchifera, were very imperfect, are here almost constant and more highly developed; the tentacula are more sensitive, and sometimes increased in number to six or eight; and there is reason to suspect that some of them occasionally minister to the sense of smell. These senses, as well as the locomotive powers of the animal, have an obvious relation with the supply of the digestive system, which is not here, as in the inferior classes, dependent upon the miscellaneous aliments conveyed to the mouth by the movement of the surrounding fluid medium, but is more limited as to the character of the food to which it is adapted, and consequently requires the means of becoming acquainted with the proximity of what it can digest. This is well seen in the common snail, which, "although at rest within the shelly covering that forms its habitation, will with great quickness

[1] A very remarkable instance of the rapidity with which these muscles sometimes act is witnessed in the case of the *patella* (limpet) and *haliotis*. The former animal, as is well known, usually adheres to those levels of rocks which are occasionally exposed to the air, and again submerged by the tide. They are favourite articles of food to crows, which sometimes pick them dexterously off the rocks—placing the point of the bill beneath the edge of the shell, which, when the animal is at rest, is usually a little removed from the rock (as in the oyster from its fellow); but, if this be not done with sufficient quickness, the animal draws its shell closely down to the rock, and holds the bill of the crow so firmly that the bird is often drowned by the rise of the tide. In like manner, men have been occasionally sacrificed in the attempt to remove a large species of haliotis which inhabits the Tropical and Southern Ocean. This animal (whose shell is much valued for its brilliancy, both on the exterior and interior surfaces) usually resides at a depth of a few feet under water. If the diver be sufficiently quick in his operations to tear the animal from the rock before it can put its retractor muscles in action, the task is not difficult; but if these are once made to contract, the shell is drawn to the rock so closely as to retain the fingers beneath it too firmly for extrication. The latter fact was communicated to the author by his friend Mr. S. Stutchbury, who has known instances of its occurrence.

perceive the proximity of scented plants which are agreeable articles of food, and promptly issue from its concealment to devour them." It is not a little curious, however, that although the general surface appears highly susceptible of impressions which excite responsive movements adapted to fulfil some important office in the economy, it does not seem to be susceptible of *painful* impressions in any thing like the same degree. This, which cannot but be regarded as a beneficent provision for the happiness of animals so helpless and so exposed to injury, would appear from the observations of various experimenters, and especially from the testimony of M. Ferrusac, who says, "I have seen the terrestrial gasteropods allow their skin to be eaten by others, and, in spite of large wounds thus produced, show no pain." The fact has an important bearing on our general views of the operations of the nervous system; since it would seem to confirm an opinion founded upon other phenomena, that the *impressions* which produce *reflex* actions through the nervous system do not always involve the production of *sensation*.

37. We may easily recognise in the nervous system of this class the same general type which it presented in the conchifera, with an advance, however, in the higher species towards a more developed condition. The *anterior* (now become *cephalic*) ganglia are larger in proportion, and exhibit a tendency to gain a position anterior to the œsophagus, and to approximate towards each other, so as to meet and form a single ganglion on the median line. The *branchial* ganglia are constantly to be met with, but their position is extremely various. This centre always, however, bears a close relation with the gills, both in situation and degree of developement; and even where apparently conjoined, as it frequently is, with the pedal ganglion, it may be distinguished from it by the distribution of its nerves, as well as by its separate connection with the cephalic ganglia, which is always noticed in such cases (§ 38 and 42.) Sometimes the functions of this ganglion are subdivided between two, of which one is still appropriated to the branchiæ, whilst the other is connected with the general surface of the mantle and respiratory passages, and hence may be called the *palleal* ganglion. The position of the pedal ganglion (which is here generally double) also varies, but in a less degree, since it is generally in the neighbourhood of the head. Where no distinct foot exists, but the locomotive movements are executed by the action of the whole mantle (as in most of the naked species, both terrestrial and aquatic,) we still find a ganglion to which they appear equally due (§ 42.)

38. As an illustration of one of those simpler forms of the nervous system presented in this class, which connect its more complex type, (to be hereafter noticed,) with that of the inferior groups of the mollusca, we may adduce that of the *patella*. At the base of the tentacula, and rather anterior, therefore, to the œsophagus, we find a pair of ganglia (A, A, Fig. 6,) which evidently correspond with the anterior ganglia in the conchifera, and which are con-

nected by a commissural band passing over the œsophagus. These, however, not only send nerves to the tentacula, but are also connected with the eyes, which are situated at their base. Beneath the œsophagus, and connected by *two* trunks with *each* of the cephalic ganglia, we find a broad mass, which, upon examination, appears to consist of four lobes placed in a line. The two inner ones (c, c,) send nerves to the foot, and are thus evidently analogous to the *pedal* ganglia of the conchifera. These are connected with the cephalic ganglia by one of the trunks which we observe on each side. Externally to them are the *branchial* ganglia (B, B,) which also are connected with the cephalic ganglia by a separate trunk, as well as with each other by a filament that may be distinctly traced through the pedal ganglia.[1] Besides supplying the gills and mantle, these ganglia, like their analogues among the conchifera, send branches to the shell muscles, and some small ones to the viscera. That they are specially *branchial* ganglia, however, is proved by this. Mr. Garner has remarked that, in *fissurella*, (an animal generally resembling patella, but differing from it in having the branchiæ removed to the back of the neck,) in which Cuvier noticed the deficiency of the two external lobes of the subœsophageal mass, the ganglia really exist, but are removed to a different position—namely, the base of the branchiæ on the back.

39. Besides these nerves, we find in the patella, as well as among the gasteropoda in general, a separate system connected with a very important set of organs, the gustatory and mandicatory, which are but slightly shadowed out among the conchifera. In these animals we find the œsophagus dilated at its commencement into a muscular cavity, with a curious rasp-like tongue, which serves to reduce the food; often supported upon cartilages, and sometimes furnished with horny maxillæ. The nerves which supply these do not proceed directly from the cephalic ganglia; but are a part of a distinct system, which sends its ramifications along the œsophagus and stomach, and which is occasionally connected with the first by inosculating filaments. This set of ganglia and nerves, which is even more important from its relative developement in some other classes, and into the analogies of which in the nervous apparatus of vertebrata we shall hereafter inquire, (§ 92, 3,) may be called from its distribution the *stomato-gastric* system. In the *patella* we find a broad ganglionic band (D) lying beneath the œsophagus, and forming with its nerves another ring round it. This band is connected, in most gasteropoda, with the cephalic ganglia; but in the patella, it sends its connecting filaments to two small ganglia (E, E,) anterior to the cephalic, which supply the lips, and which seem intermediate between the two systems. In the cephalopoda, we find these labial or tentacular ganglia attaining considerable developement; but in the gasteropods, in general, they do not appear to be separated from the cephalic.

[1] Garner, loc. cit.

40. A higher form of the nervous system is that found in the *aplysia*, which has been minutely described and well figured by Cuvier.[1] In this animal, we find that the cephalic ganglia have become entirely supra-œsophageal, and have coalesced to form one mass (A, Fig. 7.) Beneath this are two lateral ganglia (C, C,) which are connected with it and with each other, so as to complete the œsophageal ring. These ganglia supply the foot and mantle, and are, therefore, to be considered as *pedal* or locomotive ganglia. We here find indicated, however, the separation which exists in other gasteropoda and in the cephalopoda, between the nervous centres supplying the foot and the mantle; for the commissure which unites them beneath the œsophagus is not a simple nervous cord, but consists of two filaments which diverge to embrace the aorta,—a relation which they hold when proceeding from separate ganglia; and the cords which connect them with the cephalic ganglion, consist of *three* nerves on each side, of which two apparently belong to these lateral ganglia, and the third to the posterior ganglion next to be described. This ganglion (B) is situated at some distance from the others, lying among the viscera at the posterior part of the body, among which it is partly distributed. Hence it was regarded by Cuvier as a sympathetic ganglion; but there is more justice in the view of Mr. Garner[2] that it is principally a *branchial* ganglion, a large part of its nerves being distributed to the respiratory organs. It is connected by long filaments with the lateral ganglia; and part of these cords seem to pass on to the cephalic mass, forming the third of the filaments which connect it with the lateral ganglia. Besides these nerves, we find a *pharyngeal* ganglion, partly divided into two lateral lobes, lying beneath the mouth, and sending filaments to its muscles, to the salivary glands, and to the œsophagus, as well as connecting branches which unite it with the cephalic mass.

41. These characters become more positive in the nervous system of *bullœa*, where we find the cephalic ganglia again separate (A, A, Fig. 8,) and lying at the side of the œsophagus, along with two other pairs of ganglia (C, C, and E, E,) the distribution of whose nerves to the foot and mantle determines them to be *pedal* and *palleal* ganglia respectively. The branchial ganglion (B) is situated posteriorly, as in aplysia and as in the conchifera; and its cord of communication with the cephalic ganglia passes through the palleal ganglion. Two small pharyngeal ganglia are here found in the usual situation.

42. From these complex forms, which show us the distinctness of parts that appear simple, we may advantageously pass on to one which exhibits a highly-developed nervous system in nearly the most concentrated aspect that it presents in this class—that namely of the *limax ater* (common slug.) Here we find the cephalic gan-

[1] Mem. sur les Mollusques.
[2] Loc. cit.

glia (A, A, Fig. 9) united into one large bilobed mass, lying completely above the œsophagus. Another large mass, or subœsophageal ganglion, forms the lower part of the ring, and is connected with the first by *two* trunks on each side. A little examination will show that this ganglion is composed, like the similar mass in the patella, of two pairs having distinct functions. The branches from the outer portion (B) are principally distributed to the respiratory sac; and this will, therefore, be analogous to the outer or branchial portion of the ganglionic mass in the patella, being, like it, connected immediately with the cephalic by a trunk of its own. The inner portion (C) does not send its branches to the *foot* in particular, but to the general muscular surface in which this organ is, as it were, lost, and of which the whole is concerned in the progressive movement of the body. Hence we may fairly regard this as a *locomotive* ganglion. Two small pharyngeal ganglia are found within the principal ring, connected as usual with the cephalic.

43. Without going into further detail, then, it is evident that in this class the sensory apparatus, the foot or locomotive organ, the branchiæ or respiratory organs, and the mantle with whose actions both these are concerned, are the organs which seem to require nervous centres for the reception of impressions, and the excitation of respondent motions. These centres are modified, both as to situation and developement, in accordance with the situation and developement of the organs which they supply; and it is from their connections only that we can judge of their character. For example, it was seen in *aplysia* that the *pedal* and *palleal* ganglia were united, while the respiratory ganglion was separated. In *ianthina*, on the other hand, the *pedal* ganglia are distinct, whilst the *branchial* and *palleal* are partly incorporated with the cepl alic. And in *paludina*, the *pedal* ganglion being still distinct, one other pair supplies the organs of sense and muscles of the mouth, as well as the mantle, branchiæ and viscera.

44. Nothing has yet been said of the ultimate structure, and of the arrangement of the elementary portions, of the nervous apparatus in the classes in which its form has been described; because it is only among the gasteropoda, that any minute investigations have been made whose character can be relied on. It has been stated by M. Blainville, and generally believed, that the nerves of the mollusca are not composed of definite filaments, like those of higher animals, but that they consist of a semifluid *globuleuse* matter enveloped in a fibrous neurilema. More recently, however, it has been ascertained by Ehrenberg, and after him by M. Leuret,[1] that the nerves consist, in these as in other animals of definite tubular fibres, in which the granular medulla is contained. These fibres are universally cylindrical, and present no well marked variations in size. It is very difficult, if not impossible, to isolate them, however, owing to the extreme tenuity of their tubular portion; but the

[1] Op. cit. p. 24.

transparency of the neurilema enables them to be readily viewed *in situ*.

45. The structure of the ganglia presents several points of interest. They are always characterised by the presence of a central nodule of granular matter which does not seem to possess any definite arrangement. This, in the tunicata, does not differ much in colour from the other portion of the nervous structure, being of a light brownish shade. In the conchifera it is more of an orange colour: and in the gasteropoda it is of a reddish brown. It cannot be doubted that this corresponds with the gray or cortical substance of the nervous centres in vertebrata. The manner in which it is disposed in reference to the nervous fibres, at once distinguishes the ganglia of the mollusca from those of the sympathetic nerve, or of the posterior roots of the spinal nerves, in vertebrata. In the latter we observe the fibres *continuous through* the ganglia, and the gray matter interposed among them. In the former, the gray matter is confined to the centre, and is traversed by *no fibres;* and the roots of the nerves which terminate in the ganglion are observed to penetrate to it, and then to diverge,—becoming, as it were, lost in its substance.[1] This is alike the case with what are believed to be from their connections, both sensory and motor nerves. This structure obviously, therefore, resembles that of the *centres* of the cerebro-spinal system in vertebrata; the connection of the roots of the nerves with the gray matter of the spinal cord, as well as that of the fibrous with the cortical portion of the brain, being exactly the same as that just described. These ganglia, then, may be regarded as holding precisely the same relation to the nerves which issue from them, as do the corresponding parts of the centres in vertebrata. What these corresponding parts are will be the next subject of enquiry.

46. The cephalic ganglia must be regarded as analogous—not to any single portion of the encephalon in vertebrata—but in some degree to the whole. We find nerves of special sensation proceeding from them, certainly to eyes, perhaps also to olfactive organs; as well as others of common sensation supplying the tentacula and mouth. Hence we must admit, that they perform the functions of the optic ganglia of vertebrata,[2] and perhaps also of the olfactory lobes; as well as of the portion of the medulla oblongata in which the sensory portion of the fifth pair terminates. Moreover, they certainly give origin also to motor nerves; and must thus perform the functions of the portion of the medulla oblongata from which the corresponding nerves arise in vertebrata, as well as, perhaps, of the cerebellum. And, if we regard these animals as possessed of the perceptive, reasoning, and volitional faculties, in however low

[1] Leuret, loc. cit.

[2] A slight protuberance on the cephalic ganglia, analogous to the optic ganglia in the cephalopoda, may indeed be occasionally seen at the point whence the optic nerves are given off.

a degree, we must attribute to their cephalic ganglia some portion of the attributes of the cerebral hemispheres in the highest classes. This combination of functions will not appear so extraordinary, when it is recollected that *all* the central operations of the nervous system are performed in the tunicata by *one* ganglion, and in the radiata by a series, of which each is but a repetition of the rest; and it is quite conformable to the general principle of the gradual *specialisation* of function which may be observed in ascending the scale of organisation.

47. Of the *branchial* ganglion little more need be said than what has been already stated of the probable control which it exercises over the respiratory function. It will obviously be analogous to the portion of the medulla oblongata which is the centre of these actions in vertebrata; and although generally at some distance from the cephalic ganglia, the two centres are always immediately connected by a uniting trunk.

48. The *pedal* ganglion can scarcely be regarded in any other light than as analogous to the spinal cord, or rather to a single segment of it. The organ of locomotion is here single, and confined to one part of the body. Its nerves may be compared, therefore, with those supplying one of the extremities of vertebrata; and the ganglion, to the corresponding portion of the spinal cord, which generally exhibits a perceptible increase in the amount of gray matter where they enter it. It is well known that such a portion may be completely isolated without destroying the functions to which the spinal cord ministers; and we can scarcely doubt that these functions are identical in both cases. Such an isolation, however, in vertebrata, destroys the continuity of the nervous fibres with the brain, to which they seem principally connected by the white portion of the spinal cord, whose fibres may be traced into a part of their roots; and we find that, in the mollusca, the influence of the cephalic ganglia over the pedal nerves is always provided for by a communicating trunk proceeding from these centres towards the ganglion, not passing through it, however, but subdividing into branches which enter into the composition of the trunks proceeding from it; so that *a portion* of the pedal nerves terminates in the pedal ganglion, whilst another portion is derived by a continuous trunk from the cephalic. This fact is a very important one in relation to the character of the divisions of the double nervous column in the articulata, and of the spinal cord in vertebrata.

49. It is an interesting fact, stated by M. Leuret as the result of his enquiries on the subject, that, although the cephalic ganglia are generally absolutely smaller than other nervous centres, they are always larger in proportion to the nerves which proceed from them. This is worth notice in relation to the investigations of Soemmering upon the proportion which the mass of the brain in vertebrata bears to the diameter of the nerves proceeding from it.

50. It is obvious that the portion of the nervous system of mollusca, into the analogies of which we have thus enquired, cannot

be in the least compared *as a whole* with the *sympathetic* system of vertebrata, which it was formerly imagined to resemble. The distribution of some of its nerves to the viscera, however, may indicate that it partly performs the functions of that system, with which it is structurally intermixed even in vertebrata, as the late enquiries of Müller have shown.[1] But the stomato-gastric system may, perhaps, with more probability be considered as executing its offices. Into the peculiar character of that system, we shall be more competent to enquire, when we have traced it through other classes of invertebrata.

51. The nervous system of the pteropoda does not seem, from the few cases in which it has been examined, to differ much from that of the gasteropoda. In the *clio* it is described by Cuvier as consisting of three pairs of ganglia on each side, the anterior or cephalic meeting above the œsophagus, and the others being connected by filaments passing beneath it.

52. The class of cephalopoda is a most interesting one in many respects, exhibiting to us the modification of the molluscous type (which is perhaps most characteristically presented in the gasteropoda) produced by their proximity to the vertebrated division of the animal kingdom. In no organs is this modification more evident than in the nervous system; for, whilst in the lowest members of the group we find it approximating closely to the form it presents in the higher gasteropods, its whole character and relations in the most elevated species are so like those which exist in the lowest fishes, that the analogies between their several parts may be traced with little hesitation. Before passing to the consideration of these, however, it will be desirable to advert to the conformation of the sensory and locomotive apparatus in the principal groups of this class.

53. Among the lower testaceous cephalopods, of which the *nautilus pompilius* may be selected as a type, the sensory organs are but little elevated above those of the higher gasteropoda. The eyes are still imperfect; no organs of hearing can be detected; and, if there seems ground for attributing to them the possession of an organ of smell, this may with nearly equal reason be regarded as existing in some of the class below. The most remarkable difference in their sensory organs consists in the number of the tentacula which are developed from the head, and which amount to little short of a hundred. Of these some appear more expressly modified for locomotion and prehension; and others, resembling in character and situation the antennæ of crustacea and insects, may probably be regarded as instruments of sensation. The head of this animal is also furnished with a flattened disk, which has been termed the *hood*, but which evidently resembles the *foot* of gasteropods, and seems to be its principal organ of progression on a solid surface. The muscular system is, therefore, principally disposed at the an-

[1] Physiology. Book III. Chap. ii.

terior part of the animal. There are two large shell muscles, however, attaching the fleshy mass posteriorly to its testaceous envelope; and the mantle is furnished with a considerable amount of muscular substance which seems destined to dilate and contract its cavity. By this provision it would seem that currents of water are made to flow over the respiratory surfaces, on which, according to the testimony of several observers,[1] no cilia can be detected.

54. In the higher order, which principally consists of the *sepia loligo* and other naked cephalopods, both the sensory and locomotive powers attain a considerably increased developement. The eyes are larger and more perfectly organised; and distinct organs of hearing are found to exist. Instead of a number of feeble tentacula which can scarcely assist in locomotion, we find eight or ten powerful arms, adapted both for this function, and for prehension. For locomotion we find them in many species particularly modified by the membrane that connects their bases, and acts as a powerful circular fin, by means of which the animal swims through the water with great rapidity. On the other hand, the suckers with which they are enabled to take such firm hold of any object to which they are applied, admirably adapt them as prehensory organs. In other species, again, these tentacula are but slightly developed in comparison; and locomotion is effected by means of the vibrations of the long slender body, whose acting surface is assisted by the prolongation of the mantle into fin-like processes which are elevated upon cartilaginous supports. We shall now enquire into the characters which the nervous system presents in these two orders.

55. In the *nautilus* (Fig. 10.) we observe the cephalic ganglia united on the median line, and lying across the œsophagus like a cord; its two extremities are swollen into ganglionic enlargements, which are evidently analogous to the optic ganglia of vertebrata. This mass communnicates with two collars which form the sub-œsophageal portion of the ring. From the transverse cord are given off not merely the optic nerves, but also filaments to the mouth and tongue, (which are apparently of a sensory character,) as well as branches that connect it with separate labial ganglia presently to be noticed, which, as in the patella, lie at a considerable distance anteriorly. The anterior sub-œsophageal collar seems to correspond, in part, with the pharyngeal band in the same gasteropod,—here increased in size and importance on account of the increased developement of the buccal apparatus, with its powerful mandibles, firm, fleshy tongue, salivary glands, and contractile pharynx, and brought into close approximation with the cephalic ganglion. The greater number of the tentacula receive filaments proceeding directly from the anterior part of the collar; but the internal ones are supplied from a ganglionic mass which lies at their base, and which, though principally connected with the

[1] Sharpey, Owen, and Garner.

pharyngeal band also communicates with the cephalic ganglion. Besides supplying the internal labial processes, this ganglion sends twigs to what have been supposed by Mr. Owen to be *olfactory* laminæ, and, if these are so, would have to be regarded as in part an *olfactive* ganglion. Its correspondence with what has been denominated the *labial* ganglion in the patella, seems pretty evident; and perhaps the latter is also to be regarded as connected with the sense of smell.

56. From the posterior collar,—which evidently corresponds with the sub-œsophageal ganglion of the limax and other gasteropoda, in which are united the pedal palleal, and branchial ganglia,—filaments are distributed to the shell muscles, and four others arise from it which pass backwards along the course of the vena cava: of these the two internal form a plexus upon the vein; whilst the two external, which are trunks of considerable size, swell into ganglia, from which ramifications are distributed to the digestive and reproductive organs. This distribution resembles that found in many of the higher gasteropods inhabiting spiral shells; and the system of nerves may be termed *branchio-visceral*. The *external respiratory* nerves, however, that supply the muscular edges of the mantle, and the muscles of the funnel, by the movements of which the respiratory currents are produced, arise from the anterior sub-œsophageal mass, which has been spoken of as partly corresponding with the pharyngeal ganglion or medulla oblongata. There is nothing surprising in this change of situation, since we have already had to notice how constantly the position of the nervous centres is governed by that of the organs they supply; and, in this conjunction of the centres of the stomato-gastric and respiratory systems, and their approximation towards the cephalic ganglion, we recognise an evident approach towards the type of the vertebrata.

57. The supra-œsophageal or cephalic mass of the sepia, (Figs. 11, 12,) evidently possesses a much higher character than that of the nautilus. In the latter there existed, on the median line, only a sort of commissure, narrower than the rest of the band; whilst in the former we observe a distinct cordiform mass, from the lower and lateral parts of which the commissural bands proceed, that unite it with the optic ganglia, and with the sub-œsophageal mass. Although the latter is here single, it has a double connection with the cephalic ganglion; an anterior and posterior band uniting them on each side. Anterior to this, as in the nautilus, is a *labial* ganglion which is connected both with it and with the cephalic ganglion, and which supplies with branches the superior part of the mouth, especially the lips. Two branches proceed from it anteriorly, which encircle the œsophagus, and meet in a pharyngeal ganglion, of a double or bilobed form, on its under side at the base of the tongue.[1] We have here, therefore, the same separation of parts as in the patella, the *stomato-gastric* system being again insu-

[1] Brandt, loc. cit.

lated from the cephalic; the only difference is one of situation, the labial ganglion being in that instance anterior to the pharyngeal, whilst it is here posterior. Several filaments proceed from the pharyngeal ganglion, along the œsophagus, and descend to the stomach, where they reunite into a ganglion, from which branches diverge to supply the digestive system, and particularly the muscular parietes of the gizzard.[1]

58. From the anterior part of the sub-œsophageal mass arise the nerves which proceed to the tentacula; and these are evidently destined principally to the purposes of locomotion. This fact, therefore, indicates that the functions of this part are more restricted than those of the anterior collar of the nautilus, which sent off nerves to the sensory as well as to the motor tentacula, and also to the mouth, pharynx, and their muscles, which are here supplied from separate ganglia. This anterior portion also gives off, as in the nautilus, the nerves which supply the siphonic apparatus and which thus regulate the expiratory current of water.

59. From the posterior division of the sub-œsophageal mass, which is partially separated from the anterior by the aorta, are given off, first and nearest the median line, the branchio-visceral trunks, of which part form a plexus upon the vena cava, as in the nautilus, whilst the larger portion is distributed upon the viscera and branchiæ; the visceral division assisting the pharyngeal to form the gastric ganglion, and the branchial having an elongated ganglion at its points of separation. Behind and externally to these arise two large cords which have no distinct analogues in the nautilus, since they are destined to supply the posterior part of the mantle, which is here a very important muscular organ, but there was covered by the shell. Before their distribution, however, they form a large stellated ganglion, from which the nerves radiate; but where the mantle is prolonged into fin-like processes, the branches which supply these *do not* pass through the ganglia. The anterior part of the mantle is supplied by a distinct set of small nerves, corresponding with those which alone exist in the nautilus. The active motions of the posterior part of the mantle are here the great agents in producing the rapid respiratory currents, required for the complete aeration of the blood of animals whose movements are so energetic. Amongst these respiratory nerves arise, as in vertebrata, the small filaments which supply the acoustic organs. The anterior part of the mantle is supplied by a distinct set of small nerves, corresponding with those which alone exist in the nautilus.

60. Some interesting peculiarities in the distribution of the nerves supplying the arms are worth notice in this place. Just before the divergence of these members, the nervous trunks give off a

[1] Mr. Owen appears to be in error in asserting that these anterior ganglia correspond with the labial ganglia of the nautilus; since their filaments are almost entirely disposed on the lower part of the mouth, and on the œsophagus, salivary glands, &c. See Garner, loc. cit.

filament on each side, which meet corresponding filaments from the neighbouring trunks, and thus form a continuous circle uniting the nerves of all the arms.[1] It can scarcely be doubted that the purpose of this structure is to produce that *consentaneousness* of action among them, so necessary for active locomotion, especially where their movements are the only means of progression enjoyed by the animal, as in the poulp. Along each trunk is a series of ganglionic enlargements, which correspond to the suckers on the surface of the arm, and send radiating nerves to them. According to Dr. Sharpey,[2] each trunk consists of a pair of cords, of which *one* only presents ganglionic enlargements, whilst the other passes over these, without contributing to their formation. Another interesting circumstance is pointed out by Mr. Owen.[3] "In the cephalopods, whose shells are rudimentary and internal, and whose bodies are enveloped in a naked, and, as we must suppose, sensible mantle, the nerves which supply that part radiate from a ganglion, which, as in the posterior roots of the spinal nerves in the vertebrata, is interposed on the chord which brings them in communication with the central mass. In *nautilus* on the contrary, whose body is encased in an insensible calcareous covering, the analogous nerves are wholly expended on the largely developed muscles which attach the shell to the body; and these nerves, like the motor filaments of the spinal nerves, pass into the muscles directly from the brain, without the interposition of any such ganglion." If this ingenious view be correct, we should here perceive the first indication of the intervertebral ganglia of higher animals. But there is, we think with Mr. Garner, as much reason for regarding it as a *palleal* ganglion, analogous to those met with in gasteropoda, and the centre of the respiratory movements of the mantle (§ 64); whilst the trunk that passes over it, and is continuous with the œsophageal collar, would influence its movements as an organ of general locomotion.

61. In both these orders of cephalopods, the nervous centres are protected by cartilaginous supports which obviously foreshadow the *neuro-skeleton* of vertebrata. In the nautilus, the œsophageal collar rests upon a firm cartilage, which does not, however, enclose it, but gives attachment to the powerful muscles of its neighbourhood. In most of the superior order, the cephalic ganglion, with the sub-œsophageal mass, are enclosed in a cartilaginous envelope, the cavity of which, however, they do not entirely fill; the intervening space, like that within the cranium of fishes, being occupied by a gelatinous fluid disposed in cells formed by the arachnoid membrane. The expanded wings of this cartilage support and protect the eye-ball; and in its substance the organ of hearing is imbedded. The nuchal cartilage, which is placed behind it, not

[1] Cuvier, Mem. sur la Poulpe, p. 36.
[2] Müller's Physiology, i. 676.
[3] Memoir on the Nautilus, p. 57.

only gives attachment to the muscles of the mantle, but protects the great lateral nerves; and this, with the long cartilaginous plates which support the fin-like processes, where they exist, is evidently the rudiment of the osseous column, which protects the spinal cord in vertebrata, but which, in the lowest of that division, is reduced to the form of a simple cartilaginous tube, as in the cyclostome fishes.

62. The central portion of the cephalic mass in the *sepia* may perhaps be regarded as more analogous to the cerebral hemispheres of vertebrata than any thing we have as yet seen in the mollusca, since the optic ganglia are here distinctly developed in a separate form. Should the labial ganglia participate in the function of smell, their connection with the cephalic mass would evidently resemble that of the pedunculated olfactory lobes in many fishes. As this central mass contains gray matter, it is obviously something else than a mere commissure between the optic lobes, as some have represented it; but as it also gives off the lingual and maxillary nerves, we must regard it as participating in the functions of the medulla oblongata.

63. However strange it may appear to assert that the sub-œsophageal mass is a kind of concentrated spinal cord, a little consideration will show that this is really the light in which it should be viewed. In tracing the arrangement of the nervous centres in the mollusca, we have found the principle of *connections* our only safe guide; and its application here becomes of some importance. From the anterior portion of the mass are given off, as already mentioned, the nerves which supply the feet or rather tentacula; and it is therefore to be regarded as a *locomotive* ganglion, or rather as formed by the union of many such. It is only the situation of the locomotive organs around the head that occasions the giving off of these nerves from one spot, and *that* the *anterior* portion of the collar. Knowing, as we do, the varieties of position which this ganglion is capable of assuming, we cannot doubt that, if the feet had been all at the opposite extremity of the body, the ganglionic masses would have been removed to that situation; or that, if they had been disposed along the body, as in articulata, we should have had either a series of such ganglia, as in that group, or one prolonged ganglionic mass, like that presented by the spinal cord of vertebrata. That in either of these groups a concentration may take place equivalent to that which we here witness, need scarcely be pointed out; in the *crab*, for example, we have all the locomotive ganglia united into a single centre, and this only occupies the thorax, because the legs are connected with that division of the body; whilst, in the *lophius piscatorius*, and other fishes whose locomotive organs are principally disposed in the anterior part of the body, we find the *true spinal cord* or ganglionic mass soon terminating on a *cauda equina* consisting of nerves alone, like the bundle which passes backwards from the œsophageal collar of the sepia.

64. The *posterior* portion of the sub-œsophageal mass is evidently most analogous to the medulla oblongata, giving origin as it does to the auditory and respiratory nerves, as well as to those of general sense and motion. That it should be here placed *behind* the mass which we regard as analogous to the spinal cord, will not be wondered at when the relative situations of the parts supplied by these respective centres is taken into consideration. It is unnecessary, however, to draw a definite line of division between them, since they really constitute but *one* organ: and we find this part supplying, in some of the species, locomotive nerves even more important than those of the feet—those, namely, of the fin. It is an important fact, that the ganglion upon the palleal nerves formerly mentioned is constant in all the naked species; whilst the trunk that passes over the ganglion is only found in such as possess the fin-like processes of the mantle, and is distributed entirely upon those parts. We should hence be led to believe that this ganglion is connected with the respiratory functions of the mantle, which are constant in *all* of this order, and is *not* analogous to the intervertebral ganglion upon the sensory nerves, as Mr. Owen supposes. Perhaps the question might be settled by a reference to its anatomical structure—which of the two arrangements formerly mentioned (§ 45,) its white and gray portions present.

65. It can scarcely be doubted that the *branchio-visceral* nerves sent off from the posterior part of the collar, with their venous plexus, are partly of a *sympathetic* character, since we know how closely this last system of nerves is united with the sensori-motor in the classes beneath, not having yet acquired any distinct centre of its own. Such a one would here seem to exist, however, in the visceral or cœliac ganglion, to the formation of which these nerves contribute, (§ 59,) and which sends branches to the alimentary canal, generative organs, ink-bag, &c. The branchial portion of this system, however, does not enter this ganglion, but forms a small one of its own, before its distribution to the gills. This, therefore, may be regarded as principally analogous to the respiratory portion of the par vagum; and its function will evidently be to convey to the general centre those impressions from the branchiæ, the stimulus of which is necessary to keep up the respiratory movements. Such a union of the sympathetic and par vagum appears to exist, through an interlacement of their filaments, to a greater extent than has hitherto been supposed, even in man and the mammalia—but it is far greater in fishes; and it appears from the recent experiments of Dr. J. Reid, that the sympathetic is partly concerned (perhaps through the filaments of the par vagum which it contains) in conveying these impressions. The consideration of the *stomato-gastric* system we shall again defer for a time. (§ 92, 3.)

66. We shall next enquire what inferences of a general character can de deduced from the facts which have been brought together in regard to the structure and distribution of the nervous system in the mollusca and radiata. In the *first* place, we have found no

case in which nervous fibres exist without connection with a ganglionic mass, characterised by the presence of gray matter, or of something equivalent to it. We know that, in the higher animals, the separation of a nervous trunk from its centre renders it incapable of serving as the medium of reflex actions of any kind, whether sensation and volition be concerned in them or not; and we may fairly infer that the same principle extends to the lower, in which the same distinction of parts is manifest. There would seem, then, much reason to believe that ganglia are situated wherever impressions made upon the afferent nerves are destined to excite motions; and, farther, that the change by which this is effected takes place between the white and the gray matter. Thus, we have the nerves of the foot partly terminating in one ganglion, those of the respiratory apparatus in another;—and so on.

67. It may be remarked, in the *second* place, that, wherever the presence of special sensory organs confined to one part of the body gives to that part a predominance over the rest, (the entrance to the alimentary canal being always in their neighborhood,) we find the ganglia with which they are connected possessing a special relation with all the rest, which these do not possess with each other. It is obvious that, where visual organs are developed, the impressions made upon these will determine the movements of the animal, more than those of any other kind; and it would seem to be chiefly owing to the information which they communicate, that the cephalic ganglion has such an evident presiding influence over the rest, even when smaller than any one of them. This is, however, more the case in animals whose movements are rapid, and in which, therefore, the perception of *distant* objects is more important, as in the articulated classes. Except in the cephalopodo, the subservience of the nervous system to the nutritive functions of the mollusca is so great, that it might almost be regarded as an appendage to the digestive organs, destined for the selection and prehension of aliment. But in the more active members of that class, it derives a more elevated character from the developement of the organs of special sensation and of locomotion. It has been seen that filaments from the cephalic ganglia enter into the composition of all or nearly all the nerves of the mollusca; the trunks which connect them with other ganglia not terminating in those ganglia, but intermingling with the nerves which proceed from them. In the structure which Dr. Sharpey has detected in the arms of the cuttle-fish, we find a very interesting example of this general fact, (§ 60;) and it is by no means difficult to assign its use in accordance with the views here laid down. The suckers seem capable of contracting and fixing themselves, either in obedience to the will of the animal, communicated to them along the non-ganglionic cords from the central mass, or in respondence to a stimulus excited by contact, and acting through the afferent and efferent nerves of their ganglia alone. But it may be said that, in all these cases, the ganglia in the course of the trunks are equivalent to the intervertebral ganglia in

vertebrated animals, and merely distinguish the sensory from the motor portion of the trunk. Such an idea is, however, completely refuted when we apply it to the nervous system of the lower mollusca, where we find the cephalic ganglion gradually diminishing in size, until the posterior or *branchial* is obviously the *principle* centre of the actions of the animal, and cannot, therefore, be of the nature of an intervertebral ganglion. Going still lower—to the tunicata—we find this respiratory ganglion the only one remaining. The gangliated cord of the sepia, therefore, evidently repeats, on a small scale, the same characters as have been shown to exist in the larger centres of other mollusca. And this is demonstrable by experiment, as well as by structural analogy; for when the arm of a cuttle-fish is severed from its body, and the nervous cord, as a whole, has no termination in a ganglionic centre, any sucker may be stimulated to contract,—the effect being obviously produced through the nerves of its own ganglion. It is well known, that the intervertebral ganglion bestows no independent action on the spinal nerve, which is powerless when separated from its true ganglionic centre; and we cannot, therefore, but regard it as next to certain, that the ganglia in question are so many independent centres of reflex action, whose operations are controlled, directed, and combined by the cephalic ganglia, through the medium of the fibrous band that passes over them, and mixes its branches with theirs.

68. We may observe, *thirdly*, that in passing downwards to the tunicata, we find the nervous system losing one part after another, until the respiratory ganglion is all that remains. This must be regarded, however, as combining in some degree the functions of the rest (so far, at least, as the general structure of the animal allows these functions to be performed:) but the control over the movements of the respiratory sac is evidently its principal office. The mere act of respiration, or the aeration of the blood, can scarcely be regarded as dependent upon any influence derived from the nerves, for the reasons stated at the commencement of this essay, and also because it may be effected out of the body; but the working of the mechanism by which the conditions of the change are brought into play would seem an important part of the functions of the nervous system wherever such exists. Now, it has been shown by experiment that in the vertebrata the whole of the nervous centres may be removed, except that segment of the cerebro-spinal axis which connects the principal respiratory nerves—in fact, the *respiratory ganglion*,—and yet the animal may continue to exist for some time. It is curious to see how such experiments are, as Cuvier expressed it, "ready performed for us by nature," in this class of animals.

69. We may trace, in the *fourth* place, a close relation between the predominance of the cephalic ganglion, and the evidence of the operations of sensation and volition, as manifested in the movements of the animal. So long as food is within its reach, we can scarcely regard its prehension as of any higher character than that of the

infant when it applies its lips to the nipple of the mother; and this action, we know, is not dependent on the presence of the brain, and is therefore, we think, not the result of sensation or volition, although in the perfect condition accompanied by the former. But when the animal has to exercise its organs of special sensation, and to put its general locomotive apparatus into activity for the purpose of seeking its aliment, its operations must be regarded as of a higher order; yet the greater part of these may still, perhaps, be considered *instinctive*, that is to say, not involving any reasoning powers, or any notion of *purpose* on the part of the animal itself. We may take a well known case in illustration,—the ejection of the contents of the ink-bag, which takes place when the cuttle-fish is pursued. This has been regarded by some as of a *voluntary* character, and as indicating a *design* on the part of the animal to conceal itself from its pursuers. But such a supposition involves an amount of reasoning power on the part of the animal which we can scarcely attribute to it; and if the action were not performed as well the *first* time as it might be on a subsequent occasion, it would obviously be of little use. Is it not rather an involuntary or *emotional* action, analogous to the expulsion of the contents of the rectum and bladder under the influence of fear, which many of the human species know by experience to result from an impulse uncontrollable by the will? This view of its character is strengthened by the fact that the secretion of *ink* is really analogous to that of *urine*.

We shall now enquire how far these inferences are applicable to the nervous system of the articulata.

V. NERVOUS SYSTEM IN THE ARTICULATA.

70. The animals composing this group all present, in a more or less evident degree, a division into segments, which have an obvious tendency to resemble one another, as in the radiata. In the higher classes, however, this segmentation is obscured by the modifications which cause the different segments to assume dissimilar forms, and perform distinct functions. In those species, however, which may be regarded as typical of the group,—as among the myriapoda,—there is an almost perfect equality in all the segments. In such the nervous system is merely a repetition of similar parts, disposed, not in a circle, as in the radiata, but in a continuous line. The most anterior, however, has an evident predominating influence, for the reason formerly specified (§ 67); and this influence will be found to diminish with the loss, and to increase with the developement, of the faculties of special sensation which have their seat there. The locomotive powers are just as predominant in the articulated series as are the nutritive functions among the mollusca. Accordingly, we find the developement of the nervous system to bear a special reference to them; and the sensori-motor divisions of

it can be more distinctly separated from the portion which ministers to the organic functions.

71. A very brief sketch of the gradual developement of this system in the lower articulata will be here sufficient; since it is in the higher groups that its peculiarities can be best studied. In the *strongylus*, one of the entozoa, (Fig. 13,) we find a single cord running from one extremity of the body to the other, but separating into two portions to embrace the orifices of the alimentary canal, where some slight ganglionic enlargements appear; from this are given off slender filaments at short intervals, which encompass the body, whose whole surface seems equally sensitive. A similar cord has been stated by Cloquet to exist in the *ascaris lumbricoides*, divisable, however, into two filaments along its whole length; but this observer also describes another similar cord as running on the dorsal surface, and as communicating with the first by a sort of œsophageal collar. This statement has been recently controverted by Leuret,[1] who maintains that the dorsal cords are evidently vascular; and certainly their situation is not such as we could easily explain, regarding them as nervous, except upon the supposition that they are analogous to the stomato-gastric system which will be hereafter described in the higher articulata. In the *linguatula*, a single stellated ganglion is described by Mr. Owen as situated beneath the œsophagus, from which nerves diverge to supply the muscular apparatus of the mouth, and the prehensile hooklets; whilst two large cords pass backwards along the edges of the abdomen to near the posterior extremity, where they gradually become expanded and blended with the muscular tissue, (Fig. 14.)

72. A somewhat similar arrangement has been traced in the rotifera, whose nervous system, notwithstanding their minuteness, is very distinct. In Fig. 15 is represented that of the *hydatina*, which consists of a circle of ganglia surrounding the entrance to the alimentary canal, and giving off filaments to the powerful muscles of the jaws, and to the ciliary apparatus of the wheels, and also a nervous cord that proceeds backwards to the posterior extremity of the body. In the species now described, this cord is single and destitute of ganglia: but in others it is evidently double, and one or two pairs of ganglia exist upon it. Here, then, we see a concentration of the ganglia at the anterior part of the body, in opposition to the general type of the group to which this class belongs, but in accordance with the disposition of the locomotive apparatus.

73. In the cirrhopoda we find another variety in the disposition of the nervous system, the same essential type, however, being retained; and it was the discovery of the double ganglionic cord in these animals that first led to the suspicion that they should be classed with the articulata, and not with the mollusca, to which their general conformation and habits apparently liken them. In

[1] Op. cit. p. 55.

Fig. 16 is shown the nervous system of the *anatifa*, which is seen to consist of a slender nervous collar surrounding the œsophgaus, and sending filaments to the neighbouring parts, but scarcely forming ganglia above it,—this creature being, in its fixed adult state, destitute of the eyes and antennæ which it possessed when in its early condition of a free-moving crustaceous animal: from this nervous ring a double column proceeds along the body, on which ganglia are found at the points that give origin to the nerves of the members.

74. In the lower annelida, such as the *earthworm*, the conformation of the nervous system is but little different from that just described in the strongylus. A nervous cord traverses the whole length of the body, forming a ring at its anterior extremity, through which the œsophagus passes. At the anterior portion of this, we find two small ganglia, from which nerves proceed to the mouth and sensitive lips; but there are as yet no eyes. Nervous trunks are given off at intervals along the ventral cord; and, according to the recent statements of M. Leuret,[1] these are given off alternately in double and single pairs; a slight ganglionic enlargement of the cord being apparent where the double pairs are given off, but not at the intermediate points. This fact is interesting, as showing, even in this low grade, the outline of a peculiar structure which will be described in the nervous system of insects. The nervous system of the *leech* bears a general resemblance to that of the earthworm; but we here find the rudiments of a separate *stomato-gastric* system also.[2] A minute ganglion exists at the base of each of the three teeth which form the mouth; these ganglia are connected together and to the cephalic by slender filaments; and they seem also to be in connection with other filaments which may be traced on the alimentary canal. In the higher annelida, such as the *aphrodita*, the same general type is witnessed in a higher grade of developement. Eyes and antennæ exist, although imperfect in their character, and the cephalic ganglia meet above the œsophagus. The ganglia of the ventral cord are much more distinct, but nearly equal along their whole length, (Fig. 17.)

75. We next arrive at the myriapoda, which present the type of the nervous system of the articulata in a sufficiently developed form to serve as a basis for our enquiries. The cephalic ganglia receive the nerves of the eyes and antennæ, and are united on the median line; but they are still of small size, in accordance with the low developement of the sensory organs. The ganglia of the longitudinal cord are well marked, and nearly equal from one end of the body to the other; each sends off nerves to its respective segment; and the branches proceeding from the different ganglia have little communication with each other. Between the ganglia we find intermediate nerves given off, as in the earthworm, (Fig. 18.) Besides these, we find a separate system of visceral or stomato-gas-

[1] Op. cit. p. 58. [2] Brandt, loc. cit.

tric nerves, of complex distribution, (Fig. 19.) A small ganglion is placed on the median line in front of the cephalic mass, with which it is connected; and from this filaments proceed to the mouth and pass down the œsophagus to the stomach. There is another set of ganglia and filaments placed laterally: the ganglia, which are sometimes two on each side, are situated behind the cephalic mass, and communicate with the anterior ganglion by filaments passing beneath it; they also communicate with each other, with the nerves passing off from the ventral cord, and with the *recurrent* trunk (as it has been termed) proceeding downwards from the anterior ganglion; and the plexus to which they give origin is distributed upon the digestive organs.

76. We shall here stop to enquire into the ultimate structure and arrangement of some of the divisions of this nervous apparatus. The nerves themselves are composed of cylindrical tubes, like those which exist in the mollusca, but more firm. The cephalic ganglia have exactly the same structure as that formerly described (§ 45); that is to say, they contain a nucleus of gray matter, in which the roots of the nerves seem to lose themselves. When we examine one of the ganglia on the ventral cord, and the nerves which seem to originate from it, we find that each nerve has three series of roots, one of which terminates, as in the other cases, in the gray matter of the ganglion; another interlaces with those of the opposite side; whilst the third is *continuous* with the fibrous portion of the cord, which may be traced uninterruptedly to the cephalic ganglia. When the structure of the cord itself is analysed, it is seen that the fibrous tract or column is throughout distinct from that which contains the ganglionic enlargements; and that it does not contribute towards the formation of these, but passes over them (as was first observed by Mr. Newport) like the analogous trunk in the arms of the cuttle-fish. This is not to be confounded with the third and narrower tract, which is still more distinct, and possesses ganglia of its own; of this, which seems connected with the respiratory function, but which is considered the motor tract by Dr. Grant, the structure and character will be described in insects, where it is more fully developed.

77. After what has been said of the offices which the ganglia seem to perform in the mollusca, and of the relation which they bear to the cephalic mass, we should have little difficulty in applying the same views to this portion of the apparatus in the articulata, had not another explanation of a very plausible character, but founded on what we deem loose and flimsy analogies, been generally received by physiologists. When we examine the actions of this cord, we at once perceive that those of all its ganglia are similar to one another, being related only to the movements of their respective segments, and of the members which belong to them. In fact, they are *so many repetitions of the pedal or locomotive ganglion of the mollusca.* It is easily proved that the movements of each pair of feet may be produced by that ganglion

alone with which it is connected; since a single segment, isolated from the rest, will continue to perform these movements for some time under favourable circumstances. Thus, if an earthworm be cut in two whilst crawling, each portion will continue to advance, though the anterior only will permanently preserve its vitality; and, if a centipede or millipede be divided into several portions under the same circumstances, each will execute movements of progression for some time. But it is evident that these must be placed, in the living animal, under some general control, by which the consentaneousness of action that is essential to regular locomotion may be produced. This is easily proved by experiment. If in a *mantis*, for example, the nervous cord be divided between the first and second thoracic ganglia, so as to isolate the ganglionic centres of the posterior legs, the limbs will continue to move energetically, but not with a combined object, and no progression will be the result. We can scarcely suppose this general control to be exercised otherwise than by the fibrous tract which connects each of the nervous trunks immediately with the cephalic ganglia, as in the mollusca; and this must, therefore, conduct to these centres the impressions which produce sensations in them, and convey downwards from them the locomotive impulse; whilst the ganglion of each segment, with the filaments proceeding from its gray matter, will form the circle necessary for the simple reflex actions of the members.

78. But, it may be asked, what advantage has this view of the character of the ventral cord over that which is current amongst physiologists? To which question a reply may be best given by asking another. Upon what evidence is that view supported? The doctrine that the ganglionic portion of the cord is *sensory*, and the fibrous or non-ganglionic *motor*, is principally based on the assumption that the ganglia are analogous to those found on the posterior roots of the spinal nerves, into which the motor fibrils do not enter. The comparison of the structure of the two, however, completely disproves this assumption. The fibres which enter the intervertebral ganglia *pass through* them to their true centre—the spinal cord; where they are partly lost in the gray matter, and partly continuous with the white. On the other hand, part of the filaments which enter *these* ganglia *terminate* in their gray substance; whilst others become continuous with the fibrous column—just as in the spinal cord of vertebrata. It is evident, then, that their true analogy is with the segments of that cord; the fibrous tract resembling its white columns, whilst the ganglionic nodules may be compared with its gray centre, which often presents similar enlargements, and which is to be regarded as a continuous chain of ganglia. Such, perhaps, we find shadowed forth in the lowest of the vermiform tribes, where the segments are so numerous that no distinct ganglia are formed, but the single longitudinal cord seems to possess the same character throughout. Moreover, the true analogues of the intervertebral ganglia are discoverable in

some crustacea, which present minute enlargements upon the nervous trunks at a little distance from the cord.[1] The argument drawn from the proximity of the so called motor column to the viscera, and its consequent analogy with the anterior columns of the spinal cord, is obviously not alone sufficient to support the doctrine in question; especially since the respiratory column still intervenes, proving that the *arrangement* of the centres is altogether different.

78. The results of experimental enquiry seem to us conclusive against the doctrine of the sensory and motor functions of the ganglionic and fibrous columns of the ventral cord of the articulata. How is it that motions may be excited in the members of a single segment by irritating them, when, the cord being divided above and below, its two tracts have no structural communication? As they may be separately traced, in many instances at least, up to the brain or cephalic mass, *that* would seem the only point through which reflex actions could be produced—which we know is very far from being the case. As no experimental proof of the correctness of this doctrine has yet been adduced, and as its chief support is an analogy which has been shown to be fallacious, it can scarcely maintain its ground against any other which is more consonant with structural analogy and with physiological phenomena.

79. Such, it may be urged, is the opinion formerly adduced—that the ganglionic portion of the cord ministers to those reflex actions which are independent of the will, and perhaps also of sensation; whilst the fibrous column is a continuation, as it were, of a portion of each nervous trunk to the cephalic ganglia. The independence of the segments, as far as their reflex actions are concerned, and their common subordination to one presiding centre of the will, are fully explained on this supposition. It is also quite conformable to the analogy both of the mollusca and of vertebrata. We have seen that, in the former, where the ganglia are more isolated from one another and from the presiding centre, each ganglion appears to be the centre of the simply reflex actions occurring in the organ with which it is connected; but that a part of the nervous fibres which seem to enter it really pass on to communicate with the central mass, where alone, it may be surmised, *sensations* can be felt, and *voluntary* impulses excited. And, on the other hand, in the vertebrata we find the ganglionic or mixed portion of the spinal cord, and the simply fibrous tracts, performing functions respectively analogous; for, when any segment is isolated from the rest, reflex actions may be excited through it, in the production of which the white columns can scarcely participate, being structurally distinct from each other and from the ganglionic portion of the cord, and continuous only with the fibrous portion of the brain; whilst pathology supplies us with instances of the converse occurrence, namely, the destruction of the ganglionic portion by disease,

[1] Leuret, Op. cit. p. 76.

without the functions of the parts below being impaired—*their* ganglionic portion being segmentally independent, and their communication with the brain being maintained by a continuity of white or fibrous structure.[1] Other pathological cases demonstrate that, when reflex actions are excited through a segment of the spinal cord unconnected with the brain, sensations are not involved in their performance; and we might, therefore, infer from analogy that the ganglia of the cord in articulata are not the seat of *sensibility*, any more than the spinal cord of vertebrata. On this point, however, we cannot arrive at any certainty; and perhaps there is some reason, on the contrary, to believe that, in these classes, sensibility is more extensively diffused through the nervous centres than in the higher, since we find the endowments of all the ganglia becoming more and more similar as we descend the scale, until in the starfish they seem identical, and each appears the seat of some amount of sensibility to visual impressions.

80. The number and variety of the reflex actions which take place in articulata after decapitation, is very remarkable; and they seem to have a consentaneousness proportioned to the closeness of the relation between the nervous centres in different species. Thus, in the *scolopendra*, we find the ganglia of each segment distinct, but connected by a commissural trunk. Here an impression made *equally* upon the afferent nerves of *all* the ganglia, will produce a consentaneous action. Thus, M. Dugès[2] relates that, if the stigmata on one side of a decapitated scolopendra be exposed to an irritating vapour, the body will be immediately flexed in the opposite direction; and that, if the stigmata of the other side be then similarly irritated, a contrary movement will occur. But different actions may be excited in different parts of the cord, by the proper disposition of the irritating cause. In the higher classes, however, where the ganglia of the locomotive organs are much concentrated, the same irritation will produce consentaneous motions in several members, similar to those which the unmutilated animal performs. Thus, the *mantis religiosa* customarily places itself in a very curious position, especially when threatened or attacked, resting upon its two posterior pairs of legs, and elevating its thorax and the anterior pair, which are armed with powerful claws; the resemblance fancied to exist between this attitude and that of prayer

[1] Mr. Mayo long ago suggested the analogy between the fibrous portion of the spinal cord, and the trunks uniting the ganglia of the articulata, (Physiology, 2d edit.) But this analogy is not altogether correct; for these trunks partly connect the ganglia themselves, (like those between the isolated centres of *bullæa* § 41,) and are partly independent of them. More recently, Dr. M. Hall has suggested that the ganglionic portion of the cord ministers to the reflex actions of the respective segments, whilst the white tract conveys the motor influence of the cephalic ganglia. We can scarcely suppose that it has this function, however, without also conveying sensory impressions *to* those ganglia, as there is no reason to believe that this is done peculiarly by the ganglionic column.

[2] Op. cit. tom. i. p. 162.

has occasioned the specific name of the animal, but it is rather an attitude of resistance. If the anterior segment of the thorax with its attached members be removed, the posterior part of the body will still remain balanced upon the four legs which belong to it, resisting any attempts to overthrow it, recovering its position when disturbed, and performing the same agitated movements of the wings and elytra as when the unmutilated animal is irritated. On the other hand, the detached portion of the thorax, which contains a ganglion, will, when separated from the head, set in motion its long arms, and impress their hooks on the fingers which hold it. These facts prove unequivocally that the instinctive movements of these parts, which are performed in direct respondence to external impressions, require only for their stimulation the ganglionic centre with which the nerves that excite them are immediately connected.

81. Another instance, related by Burmeister, is still more satisfactory in regard to the manner in which these movements are excited. A specimen of the *dytiscus sulcatus*, from which the cephalic ganglia had been removed, executed the usual swimming motions, when cast into water, with great energy and rapidity, striking all its comrades to one side by its violence, and persisting in this for half an hour; but, whilst previously lying with its abdomen on a dry surface, no such actions were excited.

82. We shall now enquire how far these views are applicable to the remainder of the articulated classes; and we shall commence by examining in detail the nervous system of insects, of which the general characters only have yet been adverted to. In their *larva* state, we find it consisting of a chain of ganglia disposed along the ventral surface, similar to each other in every respect, and one of them appertaining to each segment; with a cephalic ganglion, more or less developed, according to the perfection of the sensory organs connected with it. In this condition, therefore, the nervous system of insects perfectly repeats that which is characteristic of the annelida; and the varieties of both correspond in the most interesting manner, (fig. 20.) Besides the nervous trunks given off from the cord at its ganglionic enlargements, (and which consist, as in former instances, of two portions derived from its ganglionic and fibrous tracts,) we find, in the lower classes, a series of nerves, given off at the intermediate points, without any apparent swelling at their points of divergence. It is not easy to ascertain the true connections of these, except in the thoracic region, where the ganglionic columns usually diverge laterally, especially when the metamorphosis is taking place into the pupa state. It is then seen (fig. 21) that a third column exists on the superior or visceral aspect of the ventral cord; and that these nerves are given off from minute ganglionic enlargements upon it, which are much more distinctly seen, however, in the perfect insect.

83. Although these nerves communicate with those of the symmetrical system, they have a separate distribution, being transmitted

especially to the tracheæ, on the parietes of which they ramify minutely, and also to the muscles concerned in the respiratory movements. The latter, however, being a part of the general locomotive apparatus, are also supplied from the ganglionic column. These transverse or superadded nerves do *not* supply the muscles which open and close the stigmata or external orifices of the tracheæ; and this might be thought inconsistent with the supposition that they are especially concerned in the respiratory function, if it were not recollected that the closure of the stigmata is an action more connected with the voluntary movements of the animal than with the mechanism of its aeration, it being in this manner that it prepares itself for flight, or for any other powerful exertion. These nerves, then, would seem analogous to those of the gills and mantle in the mollusca, and may be regarded as corresponding with the pneumonic portion of the par vagum in vertebrata, which is in like manner distributed on the air passages, and with its associated motor nerves. It is to be recollected that the respiratory apparatus of insects is diffused throughout the whole body, so that its presiding system of nerves must be proportionably extended; and we here seem to have the *branchial* ganglion of the mollusca, repeated like the *pedul*, in each segment. The enlargement of the ganglionic mass during the metamorphosis, is a very interesting fact in relation to the increased activity of the respiratory function in the perfect insect.

84. The *stomato-gastric* system obtains a high degree of developement in insects, and is usually distinct in the larva as in the imago. It consists of two distinct parts. The first of these, which is situated in the median line, has been called the *recurrent* nerve. It is described by Mr. Newport in the *sphinx ligustri*, as appearing to commence by two roots from the peduncles which connect the cephalic with the first thoracic ganglion (fig. 22.) These converge and meet in a ganglion situated on the palate, which is thus anterior and inferior to the cephalic mass. From this ganglion nerves proceed to the walls of the buccal cavity, to the mandibles, &c.; whilst the principal trunk passes backwards to the pharynx, and is distributed on the œsophagus and stomach. Mr. N. regards this ganglion as analogous to the enlargement which is found on the par vagum when passing through the foramen lacerum; but *that* is evidently of the nature of an intervertebral ganglion; and we shall have reason from analogy to regard this as the ganglionic *centre* of the system of nerves proceeding from it, and the filaments which connect it with the peduncles of the cephalic ganglia as merely cords of communication. Its position and connections fully point out its analogy with the pharyngeal ganglia of the mollusca, which are undoubtedly independent centres. Besides this median system of nerves, there is another disposed laterally, which seems of a different character. In the sphinx, we find two small ganglia behind the cephalic, which are connected with these, and also with the recurrent system, as well as with the respiratory nerves. Of the

ultimate distribution of these filaments, Mr. N. does not give a very minute account: but further details will be presently given (§ 88,) in regard to the development of this system in the perfect insect.

85. Without following in minute detail the changes which occur in the nervous system during the metamorphosis, or describing the various forms which it assumes in the different orders of insects in their perfect state, such particulars will be adduced as bear upon the objects of the present essay. It will have been observed that the nervous system of the larva is constructed in exact accordance with its means and extent of locomotion. Each segment (in general at least) possesses a pair of legs; and with each is associated a *pedal* ganglion. None of the movements of the animal (in those tribes which undergo a complete metamorphosis, to which this description more particularly applies,) are very energetic; simple and slow progression is all for which its structure is adapted; and the uniformity in the actions of its legs would render it easy to combine them at the will of the animal, even though their respective centres remain so much isolated from one another.

86. But, in the perfect insect, the whole locomotive apparatus is concentrated in the thorax. The six legs (which are now all that remain) and the single or double pairs of wings, are all developed from its three segments; and a much greater variety of action is required, as well as more complete consentaneousness, on account of the increased number and velocity of the movements of the animal. We accordingly find that the ganglionic matter of the ventral cord of perfect insects is more or less concentrated in the thoracic region; whilst the ganglia of the abdomen are usually few and small (fig. 23); the nerves to its segments, however, being given off as before at regular intervals. Upon the hypothesis that the ganglionic cord corresponds with the sensory columns in vertebrata, we should be obliged to suppose that these parts of the body are destitute of sensation, whilst they retain their motor faculties. This would seem highly improbable, since these are the very parts in which the least active movements take place, whilst the ganglionic matter is carried on to those segments which give attachment to the members whose reflex actions are so remarkable (§ 80.)

87. The three tracts of which the ventral cord has been described as consisting, may be seen in most perfect insects, especially in some of the hemiptera. The ganglia of the transverse or the respiratory series are more apparent in this condition than previously to the metamorphosis. The nerves which supply the wings are found, in all the stages of the developement of these organs to have a double origin. One root arises from the fibrous tract alone, whilst the other takes its origin from both tracts at the point of enlargement. The wings are also supplied with nerves from the transverse system, of which scarcely any go to the legs; this will be readily understood when it is considered that the wings are developed, as it were out of an extension of the respiratory apparatus,[1] and that its actions

[1] See Princ. of Gen. and Comp. Phys. p. 165 and 308.

are closely connected with these movements. There is another interesting peculiarity to be noticed in regard to the distribution of the nerves of the wings. Where the ganglionic centres which supply the anterior and posterior pairs remain distinct, there is a curious plexiform arrangement of their nerves, more or less intricate, according as the wings are destined to act with greater or less consentaneous energy, and absent when the anterior pair serve only as *elytra*, and do not assist in flight.[1] This would remind us therefore, of the circular filament which was seen to connect the nerves of the arms in the naked cephalopoda.

88. As an illustration of the stomato-gastric system in perfect insects, we may advantageously select the highly developed form in which it exists in the *gryllotalpa vulgaris*,[2] (mole cricket.) The median system appears to originate in a small ganglion, (*a*, fig. 24,) situated, as in the sphinx, anteriorly and inferiorly to the cephalic mass, (A, A,) with which it communicates by a connecting branch on each side. Its principal trunk, the *recurrent* of authors, is sent backwards, beneath the pharynx; and on this a slight ganglionic enlargement is seen, where the connecting branches are given off which unite it with the lateral system. Its ramifications are distributed along the œsophageal tube and dorsal vessel; whilst the trunk passes downwards to the stomach, where its branches inosculate with those supplied by the lateral system, and seem to assist in forming a pair of small ganglia, (*d*, *d*) from which most of the visceral nerves radiate.

89. The ganglia of the lateral system are two on each side. (*b*, *b* and *c*, *c*.) The anterior pair are the largest, and meet on the median line, just behind the cephalic ganglia, with which they communicate. Posteriorly to these lie the second pair, which are in connection with them. Two cords pass backwards on each side, one derived from the anterior, the other from the posterior of these ganglia. They run along the sides of the œsophagus and dorsal vessel, and are finally distributed on the digestive viscera, where they assist in forming the ganglia already mentioned.

90. The concentration of the ganglia in the ventral cord is sometimes carried to a much greater extent than in the example already adduced. Thus, in the *melolontha vulgaris* (cockchaffer) we find all the abdominal ganglia consolidated into one, which is situated almost immediately behind the thoracic, and sends two principal trunks directly backwards, and others diverging to supply the respective segments (fig. 25.) In the *pentatoma grisea* we observe this concentration extending to the thorax as well as to the abdomen; the sensori-motor system possessing, in all, but three ganglionic masses, appertaining to the head, thorax, and abdomen respectively, (fig. 26.)

91. Upon a comparison of the nervous system of insects with

[1] All the *facts* relating to the Anatomy of Insects, detailed in the last six sections, are given on the authority of Mr. Newport. See his papers in the Philosophical Transactions for 1832, 1834, and 1836.

[2] Brandt, loc. cit.

that of the higher mollusca, it will be seen that they differ more in the relative proportions and in the management of their parts, than in their absolute character. In both, there is a cephalic division of the ganglionic centres, in which sensibility and voluntary power appear to reside more particularly, if not entirely. In both there is a division specially appropriated to the locomotive apparatus; differing only in the multiplication of the centres in insects, conformably with the arrangement of the members they supply; and sometimes, as we have just seen, consolidated even in them into two ganglionic masses. In both we find also a division appropriated to the respiratory apparatus, in which there is a corresponding multiplication of centres in the articulata, in harmony with the universal distribution of their tracheal system. And in both we find a separate system of nerves distributed to the alimentary apparatus, and supplying the organs of mastication, (with the salivary glands,) deglutition, and digestion. Into the character of this *stomato-gastric* system we shall now enquire.

92. As a preliminary to this enquiry it is to be remarked that the *par vagum* of vertebrata is distributed to *three* separate systems—the respiratory, the circulating, and the digestive. As we know that the ultimate fibrils of nerves never anastomose, there can be no doubt that these branches might be traced separately back to their origins, and would be found to have distinct connections with their ganglionic centres. There is no difficulty, then, in understanding that the respiratory system of insects and other invertebrata may be analogous with the pneumonic portion of the par vagum, although it bears no relation with the cardiac and gastric divisions of that nerve. Looking to the distribution of the *recurrent* nerve upon the dorsal vessel, œsophagus, and stomach, we can have little hesitation in pronouncing it to be the analogue of these divisions; but its commencement in the anterior ganglion, which also supplies the mouth and pharynx, might seem to place it on a different footing. With what does this anterior ganglion correspond?

93. It may be inferred from the situation and distribution of its nerves, that the *anterior ganglion* of insects is analogous both to the *labial* and *pharyngeal* ganglia of the sepia and patella (§ 57 and 38.) These would seem to form a division of the nervous system, by which the actions *immediately* concerned in the prehension of food are performed, almost as independently of the cephalic ganglia as are those of respiration. There would seem, however, a greater tendency towards the union of *these* centres with the œsophageal collar than of those presiding over the respiratory function, which is more independent of the will; and, accordingly, we find the *labial* ganglia apparently united with the cephalic in most of the gasteropoda, whilst the *pharyngeal* forms a part of the sub-œsophageal mass in the nautilus. The division of the nervous system in vertebrata, with which this stomato-gastric system corresponds, is a question of more apparent difficulty; but

if we bring into comparison not only the highest but the lowest forms of the cerebro-spinal apparatus, the chief difficulties will be removed. The analogies drawn from the distribution of the nervous branches would lead us to infer that the *third* division of the fifth pair, (including its sensory and motor origins,) glosso-pharyngeal, and the gastric portion of the par vagum, would most nearly represent it. Now, when the fifth pair is traced back to its true origin, it is found to be not a cerebral but a spinal nerve; and it is then seen to arise from the medulla oblongata in such close approximation with the par vagum and glosso-pharyngeal, as to show that, if this portion of the nervous centres were isolated from the rest, the nerves which proceed from it would form, anatomically as well as functionally, a natural group. The fifth pair, like other spinal nerves, may act in a simply reflex character; although in man it is usually under the dominion of the will. In the lower animals we find these reflex actions bearing a much larger proportion to the voluntary, than in man; and even in him we not unfrequently meet with cases in which the functions of the cerebral hemispheres seem suspended, whilst those of the spinal cord are unimpaired; so that the prehension of food by the lips may take place without any effort of the will. A remarkable instance of this kind, in which the cerebral hemispheres were entirely absent, has already been mentioned, (§ 69.) Further, the connection between the fifth pair and the par vagum is very intimate in fishes—the class which approaches nearest in the character of its nervous system to the invertebrata. We may reasonably infer, then, that the stomato-gastric ganglia are the centres of the reflex actions of the nerves which correspond to the third branch of the fifth pair, the glosso-pharyngeal, and the par vagum of vertebrata; whilst the branches which connect them with the cephalic ganglia bring them more or less under the influence of the latter, (§ 100, XIII.)

94. This view is strengthened by the connection which these nerves have with the *sympathetic* system; a connection which is much more intimate in fishes than in the higher vertebrata, though even in these, according to Müller, filaments of the sympathetic may be abundantly detected in the fifth pair and par vagum. Now, we have seen that, in the mollusca, the sympathetic does not exist as a separate system, but would seem partly connected with the stomato-gastric, and partly with the branchio-visceral nerves. In insects, the *lateral* ganglia of the stomato-gastric system appear to possess more particularly the characters of the *sympathetic;* especially in their connection with all the other systems, and in the share which their branches have in the formation of the cæliac ganglia.

95. It is scarcely necessary to extend this essay to the detailed consideration of the nervous systems of the other groups of articulata; since these will not supply us with any data which have not been already obtained from other sources. A very general outline of them will therefore suffice. The crustacea present to us a

great variety of forms of this apparatus; some resembling the type characteristic of the myriapoda, and corresponding with the equality in the segments and legs exhibited in the group; and others manifesting a degree of concentration even surpassing that of the highest insects. Of the first type, the nervous system of the *talitrus locusta* (sandhopper) is an interesting example, from its exhibiting to us the lateral divisions, which are usually in close approximation, at a considerable distance from one another, (fig. 27.) The transverse cords which unite each ganglion are evidently but prolonged forms of the fibres which have been formerly described, (§ 76,) as uniting the nerves of each side, where the ganglion appears to be single.

96. In the *astacus marinus* (lobster) we have an example of a form, which corresponds with that of insects, in which the process of concentration has taken place but to a low degree. The thoracic ganglia remain distinct, and none of the abdominal ganglia are absent, although they are much smaller than the thoracic, (fig. 28.) The stomato-gastric system here presents us, however, with an interesting variety of conformation, which shows its tendency to approximate with the cerebro-spinal. That of the *astacus fluviatilis* (cray-fish) is represented in fig. 29.[1] We here find no separate anterior ganglion existing; but it seems replaced by two small ganglionic enlargements of the cords or peduncles which unite the cephalic ganglia with the first thoracic. From these proceed the branches which supply the mouth and muscles of the jaw, as well as others that unite with a median branch proceeding from the cephalic ganglion to form the recurrent trunk, which is distributed upon the œsophagus and stomach, where it presents one or two minute ganglionic enlargements. It is evident that the small ganglia upon the peduncles of the cephalic mass correspond exactly with the division of the medulla oblongata, from which the fifth pair and the par vagum are given off; so that the analogy which has been previously drawn would seem by this structure to be fully confirmed; and we shall be less inclined to adopt the opinion of Müller, who has described this stomato-gastric system in the light of a sympathetic.[2]

97. It is in the short-bodied crabs that the concentration of the ganglionic masses is most remarkable. Thus, in the *maia squamado* we find but one large stellated ganglion in the trunk, from which the nerves radiate; a conformation which evidently conducts us towards the cephalopodus mollusca, (fig. 30.)

98. The distribution of the nervous system in the arachnida is not dissimilar to that of the crustacea—the spiders of the sea. In the long-bodied *scorpions* there is a large mass surrounding the œsophagus, formed by the union of the cephalic with the first thoracic or infra-œsophageal ganglion, from which the nerves of

[1] Brandt, loc. cit.
[2] Nova Acta, tom. xiv.

the five pairs of legs are given off; and posteriorly to this are seven small ganglia disposed at regular intervals along the trunk. In the *spiders*, (fig. 31,) on the other hand, we find the cephalic ganglia distinct but small; and these communicate with a large stellate mass in the front of the thorax, which appears to be formed by the union of at least four pairs of ganglia, and which sends off nerves to the legs; from this proceeds a double cord, which swells at its termination into an enlargement that gives off branches to other organs. The stomato-gastric system of arachnida, so far as it has been detected, seems more analogous to that of crustacea than to that of insects.

99. From the foregoing details, regarding the nervous system of the articulata, it would therefore appear that the inferences which were drawn from the examination of its character in the mollusca are fully applicable to the physiological explanation of its structure in this division of the animal kingdom, and thus derive important confirmation from its phenomena; whilst the explanation usually adopted is neither consistent in itself, nor capable of being applied to the other invertebrata. The study of the arrangement of the parts of the nervous system in mollusca may be *most* advantageously pursued before that of the articulata is entered upon; since the great variety in the disposition of the different systems in that group, the isolation of their nervous centres, and the transposition and recombination of these in so great a variety of ways, affords us the key to their real character, which may be effectually applied to the elucidation of the more complex apparatus of articulata.

VI. GENERAL CONCLUSIONS.

100. A general review of the ground over which we have passed will enable us, we think, to draw the following conclusions with a high degree of probability.

I. That a nervous system, in the form of connected filaments with ganglia on certain parts of them, exists in all animals, (that is, in all beings endowed with any degree of sensibility and voluntary power,) although its presence may not be detected by our means of observation.

II. That the actions most universally performed by a nervous system are those connected with the introduction of food into the digestive cavity.

III. That we have reason to regard this class of actions as every where independent of volition, and perhaps also of sensation;—the propulsion of food along the œsophagus in man being of this character.

IV. That, for the performance of any action of this nature, a nervous circle is requisite, consisting of an *afferent* nerve on the peripheral extremities of which an impression is made;

a ganglionic centre, where the white fibres of which that nerve consists terminate in gray matter, and those of the efferent nerve originate in like manner; and an *efferent* trunk conducting to the contractile structure the motor impulse, which originates in some change of the relation between the gray and white matter.

V. That such actions may be regarded as the simplest of those which the nervous system performs, and most resemble the examples of contraction produced by the irritation of distant organs in plants, (where an *impression* is mechanically conveyed by the circulating system,) of any which the animal kingdom affords.

VI. That in the lowest animals such actions constitute nearly the entire functions of the nervous system; the amount of those involving sensation and volition being very small.

VII. That, as we ascend the scale, the evidence of the participation of true sensation in the actions necessary for the acquirement of food, as shown by the developement of special sensory organs, is much greater; but that the movements *immediately* concerned with the introduction of food into the stomach remain under the control of a separate system of nerves and ganglia, to the action of which the influence of the cephalic ganglia,—the *special* if not the *only* seat of sensibility and volition,—is not essential.

VIII. That, in like manner, the active movements of respiration are controlled by a separate system of nerves and ganglia, and are not dependent upon that of sensation and volition, though capable of being influenced by it.

IX. That the centres of these systems are brought into closer structural relation with that of the sensori-volitional system as we ascend the scale of invertebrated animals; until they at last apparently become a part of it, as in vertebrata, where, however, they still remain separate, and may be artificially insulated.

X. That, whilst the actions of these systems are in the lower tribes almost entirely of a simply reflex character, we find them, as we ascend, gradually becoming subordinated to the will; and that this is effected by the mixture of fibres proceeding directly from the cephalic ganglia with those arising from their own centres.

XI. That the locomotive organs, in like manner, have their own centres of reflex action, which are independent of the influence of volition, perhaps also of sensation.

XII. That the influence of the will is conveyed to them by separate nervous fibres, proceeding from the cephalic ganglia; and that similar fibres probably convey to the cephalic ganglia the impressions destined to produce sensations.

XIII. That the stomato-gastric, respiratory, and locomotive centres are all united in the spinal cord of vertebrata, where they

form one continuous ganglionic mass; and that the nerves connected with all these also receive fibres derived immediately from the cephalic ganglia.

XIV. That whenever peculiar consentaneousness of action is required between different organs, their ganglionic centres are united more or less closely; and that the trunks themselves are generally connected by bands of communication.

XV. That the sympathetic system does not exist in the lowest classes in a distinct form;—that the nervous system of the invertebrata, taken as a whole, bears no analogy with it;—that, as the divisions of this become more specialised, some appearance of a separate sympathetic presents itself;—but that this is never so distinct as in vertebrata.

XVI. Hence it may be inferred that, as the sympathetic system is *not* developed in proportion to the predominant activity of the functions of organic life, but in proportion to the developement of the higher division of the nervous system, its office is not to "preside over" the former, but to bring them into relation with the latter; so that the actions of the organs of vegetative life are not dependent upon it, but influenced by it in accordance with the operations of the system of animal life.

EXPLANATION OF THE FIGURES.

PLATE I.

Fig.

1. Nervous system of *Asterias* (after Tiedemann;) *a*, oral orifice.
2. *Ascidia Mammillata*, with nervous system (Cuvier;) *a*, branchial orifice; *b*, anal orifice; *c*, ganglion with radiating filaments; *d*, general surface of the sac.
3. Nervous system of *Oyster* (Garner;) A, A, anterior ganglia; B, posterior ganglia; *a*, branches to mantle; *c*, *c*, branches to the gills; *d*, *d*, connecting trunks; *e*, transverse filament uniting anterior ganglia; *f*, arch over œsophagus, ε.
4. Nervous system of *Pecten* (Garner) A, A, anterior ganglia; B, posterior or branchial ganglion, bilobed; C, pedal ganglion.
5. Nervous system of *Mactra* (Garner;) A, A, anterior ganglia nearly meeting over œsophagus, ε; C, pedal ganglion.
6. Nervous system of *Patella* (Cuvier and Garner;) A, A, cephalic ganglia; B, B, branchial ganglia; C, C, pedal ganglia; D, pharyngeal ganglion; E, E, labial ganglia.
7. Nervous system of *Aplysia* (Cuvier); A, cephalic ganglion; B, branchial ganglion; C, C, pedal and palleal ganglia; D, pharyngeal ganglion; *a*, passage of aorta.
8. Nervous system of *Bullæa* (Garner); A, A, cephalic ganglia; B, branchial ganglion; C, C, pedal ganglia; D, D, pharyngeal ganglia; E, E, palleal ganglia.
9. Nervous system of *Limax* (from Fig. in Baly's translation of Müller's Physiology;) A, A, cephalic ganglia; B, B, respiratory portion of sub-œsophageal ganglion; C, locomotive portion; D, pharyngeal ganglia.
10. Nervous system of *Nautilus*, (Owen); A, cephalic ganglion; *a*, *a*, optic ganglia; B, B, anterior portion of sub-œsophageal collar; C, C, posterior portion; *b*, *b*, filaments to mouth and tongue; *c*, *c*, branches to tentacula; D, D, labial ganglia; *e*, *e*, branches from posterior collar to shell-muscles; *f*, *f*, branchio-visceral nerves; *g*, *g*, their ganglia; *h*, plexus upon vena cava.
11. Nervous system of *Sepia*, (Owen and Garner); A, cephalic ganglion; *a*, *a*, optic ganglia; B, anterior portion of sub-œsophageal collar; C, C, posterior portion; D, labial ganglion; E, bilobed pharyngeal ganglion; ε, passage of œsophagus; *b*, *b*, nerves to arms; *c*, *c*, palleal nerves; *d*, *d*, their ganglia; *e*, *e*, branchio-visceral nerves; *f*, *f*, their ganglia; *g*, plexus on vena cava.
12. Lateral view of nervous centres in *Sepia*, (Garner); A, cephalic mass; B, anterior portion of sub-œsophageal mass; C, posterior portion; D, labial ganglion; E, pharyngeal ganglion.

PLATE II.

Fig.

13. Nervous system of *Strongylus gigas*, (Owen); *a*, *a*, collar surrounding oral orifice; *b*, *b*, similar collar around anus.
14. Nervous system of *Linguatula tœnioides*, (Owen); *a*, ganglion beneath œsophagus, &c.
15. Nervous system of *Hydatina*, (Ehrenberg.)
16. Nervous system of *Anatifa*, (Cuvier); *a*, *a*, collar surrounding œsophagus, &c; *b*, *b*, *b*, locomotive ganglia supplying members.
17. Nervous system of *Aphrodita*, (Milne Edwards.)
18. Nervous system of *Scolopendra*.
19. Stomato-gastric system of *Spirobolus*, (Brandt); A, A, cephalic ganglia; *a*, anterior median ganglion; *b*, *b*, and *c*, *c*, lateral ganglia.
20. Nervous system of *larva* of *Sphinx ligustri*, (Newport.)
21. Portion of cord from thoracic region of ditto, when just passing into the pupa state; A, A, ganglia of regular system; *a*, *a*, ganglia of respiratory nerves; B, B, nerves of regular system; *b*, *b*, transverse or respiratory nerves.
22. Stomato-gastric system of *Sphinx*; A, A, cephalic ganglia; *a*, anterior median ganglion; *b*, *b*, lateral ganglia.
23. Nervous system of perfect insect, (Newport.)
24. Stomato-gastric system of *Gryllotalpa*, (Brandt); A, A, cephalic ganglia; *a*, anterior median ganglion; *b*, *b*, and *c*, *c*, lateral ganglia; *d*, *d*, cœliac ganglia.
25. Nervous system of *Melolontha vulgaris*, (Strauss); A, cephalic ganglion; B, C, thoracic ganglia; D, abdominal ganglion.
26. Nervous system of *Pentatoma grisea*, (Dufour); A, cephalic ganglion; B, thoracic ganglion; C, abdominal ganglion.
27. Nervous system of *Talistrus locusta*, (Milne Edwards.)
28. Nervous system of *Astacus marinus*, (Milne Edwards.)
29. Stomato-gastric system of *Astacus fluviatilis*, (Brandt); A, cephalic ganglion; B, first thoracic do.; C, C, communicating cords; *a*, *a*, stomato-gastric ganglia on do.; *b*, *b*, branches to mouth; *c*, *c*, branches to form recurrent; *e*, *e*, recurrent passing downwards to stomach.
30. Nervous system of *Maia squamado*, (Milne Edwards.)
31. Nervous system of spider, (Audouin.)

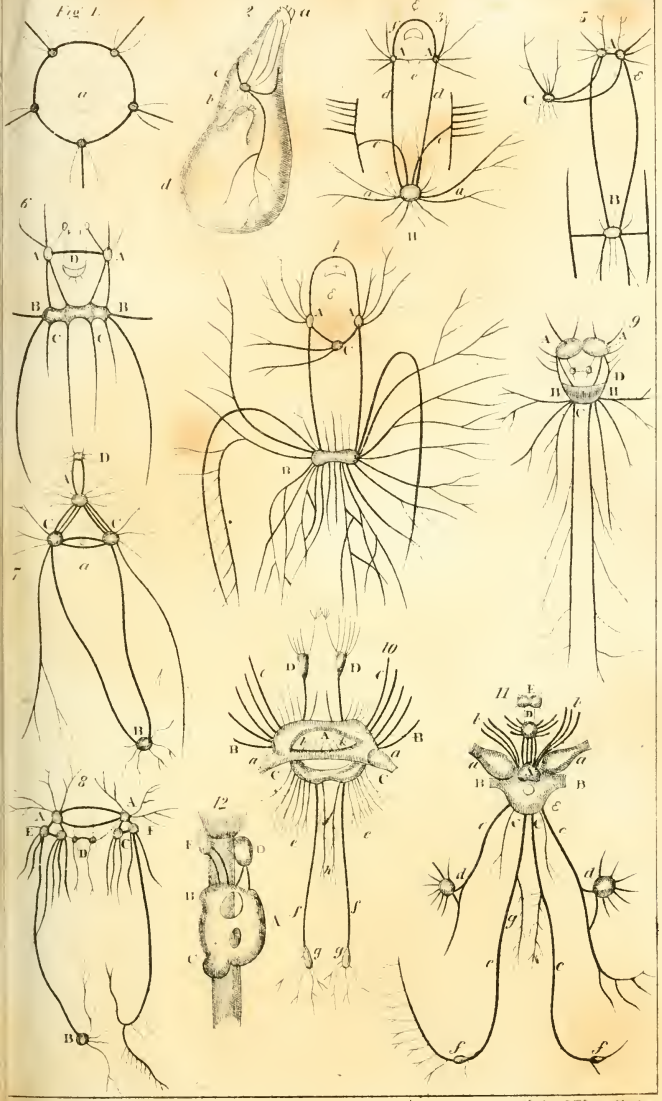
Fig. 1.
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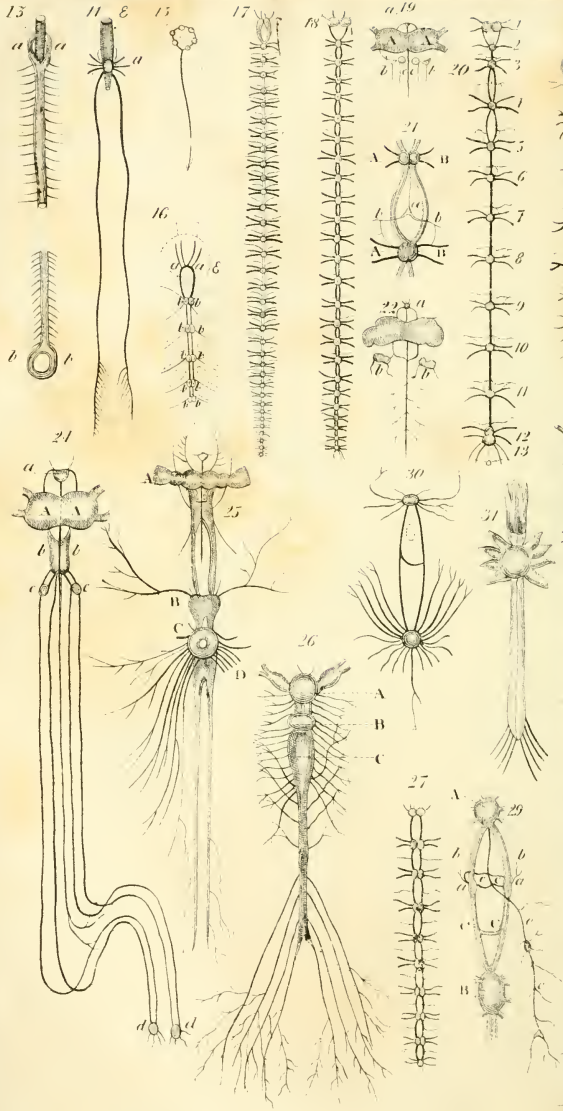

Lith. of T. Bowen, 4 Walnut St.

MEMOIR

ON THE

RADICAL CURE OF CLUB-FOOT.

BY H. SCOUTETTEN, D. M. P.

Professor of Medicine, Adjunct Professor in the Faculty of Strasburg, Professor of Operative Surgery, Member of the Academy of Natural Sciences of Berlin; of the Royal Medical Society of Copenhagen; of the Royal Academy of Metz; of the Royal Academy of Sciences of Toulouse; of the Society of Medical Emulation of Paris; of the Royal Society of Sciences of Lille; of the Society of Sciences of the Department of Lower Rhine; of the Royal Medical Society of Marseilles; of the Philosophico-Medical Society of Wurtzburg, &c.

WITH SIX PLATES.[1]

TRANSLATED FROM THE FRENCH.

BY F. CAMPBELL STEWART, M. D.

OF WILLIAMSBURG, VA.

To THOMAS HARRIS, M. D.

SURGEON, U. S. N.

THE INDEFATIGABLE PROMOTER OF SURGICAL SCIENCE,
THIS TRANSLATION IS RESPECTFULLY DEDICATED BY HIS
WARM FRIEND AND FORMER PUPIL.

PREFACE.

The great success obtained by European surgeons in the treatment of distortions of the feet, by simply dividing the tendons of such muscles as may by their contraction have occasioned an anormal deviation, has attracted the attention of some of our most eminent physicians and surgeons, and, in many instances, the operations have been repeated in this country, and so far with uniform success. Such operations, however, have as yet been principally confined to the larger cities, where every facility is afforded for the fabrication of such machines and other apparatus as are essential to the success of the after-treatment, and where able assistance is always at hand in case of accident.

The operation itself, as now practised, has been but recently introduced, and all the information on the subject, which has been afforded to members of the profession, located at a distance from the great medical emporia, has been a casual, and often incomplete re-

[1] Originally published as a separate work in 8vo., pp. 118. Paris and London, 1838.

port, generally of the result only of cases treated—furnished them through the medium of our numerous scientific periodicals.

Until the publication, during the past winter, of a very small memoir, entitled *a lecture* on "loxarthrus, or club-foot," by a surgeon of Philadelphia, who has had numerous opportunities of treating the disease, and who, from his constant success, may be regarded as one of the most experienced of our surgeons in this branch, no systematic notice had been taken in this country of the malady and its treatment. In France two works on the subject recently appeared nearly simultaneously, the one by a celebrated Parisian orthopedist, and the other by a no less distinguished surgeon of Strasburg—and thinking that there was a demand for accurate knowledge on so important a subject, I undertook the translation of the treatise of M. Scoutetten, which is now offered to the profession.

If asked why I have given the preference to this work over that of M. Duval, I should be at a loss to answer, inasmuch as both authors have done ample justice to the subject, and both works are accompanied by engravings illustrating the varieties of the disease, and by cases. Perhaps the great quantity of cases introduced into the work of Duval, which swell it out to a much larger size than that of Scoutetten, and the number of engravings (no less than seventy-eight) interspersed through its pages, the republication of which would make the book costly, have occasioned my preference of the latter memoir.

It is confidently asserted that all the information required for practical purposes is included in the following pages, and so minute has our author been in his descriptions of the surgical anatomy and *modus operandi*, that any well-informed surgeon may now, with perfect safety, undertake the task of rectifying club-feet.

One word in reference to the terms used for distinguishing the varieties of the disease. It will be perceived that our author has abandoned the expressions *varus*, *valgus*, and *pes equinus*, which he considers incorrect, and has substituted a very simple nomenclature, derived from the actual position of the parts. It is much to be regretted that so great a discrepancy should exist in our scientific vocabulary, and such a number of expressions used, as are likely to confuse.

M. Duval has added to the difficulty, by introducing terms with Greek derivations. His appellations for the varieties of the deformity are *strephendopodia*, *strephexopodia*, *strephypopodia*, *strephanopodia*, and *strephocatopodia*.[1]

This unacceptable innovation is the more to be regretted, as the author can find no better reason for relinquishing the other appellatives, which he acknowledges to be "*clear and positive*," than

[1] From στρέφω, *to turn* or *twist*,—and ποῦς, ποδος, *foot*, with the addition of ἔνδον, *inwards*, ἔξω, *outwards*, ὑπὸ, *downwards*, ἄνω, *upwards*, and κάτω, *underneath*.

"*because they are a little periphrastic, and might appear to certain persons not to be sufficiently learned.*"[1]

It is to be hoped that American surgeons will conform to one set of phrases, and not use all indiscriminately. If there are objections to those used in the following pages—and I must confess that I cannot find them—let others be substituted, and invariably conformed to.

TRANSLATOR.

WILLIAMSBURG, VA., *August*, 1839.

MEMOIR

ON

THE RADICAL CURE OF CLUB-FOOT.

HISTORY.

WHEN the foot is deformed by the contraction of one or more of the muscles of the leg, or by a primitive mal-position of the bones of the tarsus, there results a disease which has been denominated by French physicians *club-foot*, (pied-bot.)

All the muscles of the leg are liable to retraction; but it is only the more powerful ones that are capable of modifying the form of the foot. No example has as yet been presented of a simultaneous retraction of all the muscles of the leg; most commonly one or two only are affected at a time.

There are four principal varieties of the disease, viz: *inverted*, *everted*, *phalangian*, and *calcanian club-foot.*

[2] A contraction of the solei and gastrocnemii muscles, (muscles solaire et jumeaux,) contributes to the developement of *inverted club-foot.* That of the peronei, often assisted by the gastrocnemii, causes the foot to be turned *outwards.*

Phalangian club-foot is occasioned by an energetic contraction of the gastrocnemii and solei muscles, aided, in some cases, by that of the flexors of the toes; and *calcanian club-foot*, under the influ-

[1] Traité pratique du Pied-bot. Paris, 1839, p. 13.

[2] Finding no term in use to express that deformity of the foot which does not permit it to touch the ground, except by the calcaneum, I have called it *calcanian club-foot*, and, consequently, I call *phalangian club-foot* that which touches the ground only by the phalanges. I replace with these last words that of *pes equinus*,—an improper expression, and which ought long since to have been abandoned. What is there in common between our foot when thus deformed, and the foot of a horse?

ence of the contractions of the tibialis anticus, assisted most generally by that of the tendons of the extensors of the toes. There are several intermediate forms of the disease, besides those four principal ones; they are, however, all more or less closely allied to the types indicated. All the above deformities may be either *congenital* or *accidental*.

Such mal-formations of the foot as those just spoken of, were known to physicians of the most remote antiquity. The Greeks called Σκλαιτὸς the foot turned outwards, and ἐσκαιὸς, that inwards. Hippocrates, however, employed the word Κυλλὸς.[1] The Latins commonly used the words *varus* to signify the variety *inwards*, and *valgus* that *outwards*. Plautus, *in Milite*, uses occasionally the words *compernis*, *pœtus*, and *brochus*.[2] C. Hoffman, however, is of opinion that this is a mistake,—that the sense of the two expressions should be inverted, and the name of *valgus* given to that deformity commonly known as *varus*;[3] his opinion, however, has not prevailed. The Greek words were still further latinised, and the expressions *blæssus*, or *blæsus*, have been in use.

Hippocrates was not satisfied with merely indicating the evil; he also pointed out the means of combating it. Having described with great care the mode of applying the bandage, he insists that the foot must be *gradually* brought back towards its normal position: *neque magnâ vi, sed leniter cogantur*.[4] After the bandage has been applied, he (Hippocrates) recommends that the foot should be kept in its proper position by means of a leaden shoe, made in the form of those of Chio; and if that prove insufficient, he gives the model of boots which are to be applied.

This passage, from the father of medicine, presents another example of the power of his genius; for, instead of neglecting a disease, which might have seemed to him of but little importance, he describes its very forms and varieties, points out clearly the rules to be followed in the treatment, and during a period of more than two thousand years, the most expert of his successors have but reproduced his ideas and precepts. Celsus, so often remarkable for the exactitude and excellence of his descriptions, does not even mention the name of the disease under consideration, and it is not until the time of Marcus Aurelius Severinus that we find a treatise published on the subject of club-foot.[5] His description and treatment leave much to be wished for; it is, in fact, far inferior to that of Hippocrates.

Ambrose Paré,[6] after advising some tonic remedy, the formula

[1] Περὶ ἄρθρων.

[2] See M. A. Severinus *de gibbis*, *valgis*, *varis*, cap. 11.

[3] Castelli Lexicon, p. 106, verb. *blæsus*.

[4] Hippocratis opera; interprete Foësio: de articulis, sect. vi. p. 98, 99, editio Francofurti, 1595.

[5] De reconditâ abcessuum naturâ: lib. vi. de gibbis, valgis, varis et aliis ab internâ vi varie luxatis.

[6] Works of Amb. Paré, lib. xxiii. chap. xi.

for which is to be found in M. A. Severinus also, gives a model of boots, such as he proposes for remedying the disease. Dionis[1] appears to have been still less inspired than his predecessors, for he has the hardihood to advise, for maintaining the foot in its proper position, an iron boot, which had been previously proposed by Fabricius of Acquapendente.

Important publications, however, were made about the beginning of the eighteenth century, and men, none of whom were without merit, devoted themselves to the study of the treatment of the disease, and enriched science with useful discoveries.

Venel, a physician of Orbe, in the canton of Berne, established, about the year 1780, an hospital destined exclusively for the reception of children with deformed feet; he performed a number of fortunate cures, which quickly drew attention to him. Venel concealed his method, but it was divulged in 1790. Ehrmann, of Frankfort-on-the-Maine, learned it from a young physician of the name of Wantzel, who had been cured of a distorted foot in Venel's institution. He confided the secret to Augustus Bruckner, of Gotha, who, at a later period revealed all the details.[2] Wantzel himself, after the lapse of several years, published a dissertation on the subject. In England, many physicians also directed their attention to the rectifying of club-feet. Jackson, following the example of Venel, published a memoir, in which he describes many cures obtained by means of apparatus, which he claimed as his own invention, but the construction of which he kept a profound secret.[3] About the same time, in France, Tiphaisne and Verdier, surgeon-bandagists, boasted, through the public journals, of their success in the treatment of the malady by the aid of newly-invented machines. Until that period empiricism, and often ignorance, had experimented upon such unfortunate individuals as were affected with club-foot, for neither anatomy nor physiology had then sanctioned the theories which directed the operations of the orthopedists. Fortunately, it was not long before science obtained the victory, and ignorance no longer triumphed.

At the commencement of the nineteenth century, Scarpa published his admirable treatise on the disease.[4] The illustrious Professor of Pavia did not follow the common route; he did not seek to remedy it, before making himself familiar with the malady, but strove first to find out the cause of the deformity, and when he had been successful, showed conclusively, what no one had done

[1] Cours d'opérations de chirurg. 8vo. édition, p. 774.

[2] Ueber einwärts gedrehte Füsse, und deren Behandlung besonders nach Dr. Venel's Methode.

[3] Dissert. de talipedibus varis, in 4to. Tubingæ, 1798.

[4] Memoria chirurgica sul piedi torti congeniti dei fanciulli, et sulla maniera di corregere questa difformità: con tavol. Pavia, 1803, in 4to. This treatise exists in the French language, in the Memoirs of Physiology and Practical Surgery, by Ant. Scarpa. Translation of J. B. Léveillé. Paris, 1804.

before him, that the bones of the tarsus in such cases are never luxated, but only partially separated from their mutual contact, and turned according to their smallest axis.[1] The knowledge of this important anatomical fact ought to have led Scarpa to conceive a good apparatus for treating the disease, which in fact he did, and succeeded as well as such a plan of treatment admitted of.

At a more recent period, Boyer[2] invented a machine simpler than that of Scarpa, and he succeeded with it in restoring feet most singularly distorted inwards. It was not yet exactly known what was the process of Venel, when M. Louis d'Ivernois, a pupil of the successor to that orthopedist, published an account of it in 1817.[3]

Before doing so, however, M. d'Ivernois had submitted the machine of Venel to the Society *du Cercle Médical*, which appointed M. Capuron to report on it.[4] Useful improvements were the result of this investigation, which contributed to the success obtained by the author.

The remarkable work of Delpech, entitled *de l'orthomorphie*,[5] terminated this series of useful publications on the reducing of club-foot by means of machines. In it the author treats with much talent of the etiology of the disease, and proposes the employment of a new apparatus, of which he gives a representation in one of the last plates. Delpech by no means restricted himself in this work to indicating machines as our only resource in the treatment of the malady under consideration, for he recurred to the proposition which he had before made[6] of cutting the tendo Achillis, after all means of extension shall have been found to fail. This was the era at which an immense progress, I might almost say revolution, in the treatment of the disease commenced.

Although Delpech may not have been the first physician to whom the idea occurred of resorting to the section of the tendo Achillis for obtaining the cure of club-foot, it must nevertheless be admitted that he is the first who ventured to propose the operation as a useful and sometimes indispensable resource in certain cases—who established the method, and laid down regular precepts.[7] This much credit certainly belongs to him, and French surgeons should defend his claims to it. What if the operation was performed for the first time in 1784 in the presence of Thilenius,[8] a physician of the

[1] P. 114. Translation of Léveillé.

[2] Traité des maladies chirurgicales, t. iv. p. 613, 2e édit.

[3] Essai sur la torsion des pieds, in 8vo. Paris.

[4] Gazette de Santé, p. 178, Aug. 1814.

[5] De l'orthomorphie par rapport à l'espèce humaine, in 8vo. Paris, 1828; t. ii. p. 321.

[6] Précis élémentaire des maladies réputées chirurgicales, in 8vo. Paris, 1816, t, i. p. 669.

[7] Chirurgie clinique de Montpellier, in 4to. 1823.—Mémoire sur les pièdsbots: le malade fut opéré en 1816.

[8] Thilenius, chirurgische Bemerkungen, 1784.

environs of Francfort, and afterwards by Michaelis,[1] and Sartorius in 1812?[2] They were isolated cases, and of no value, inasmuch as they were destitute of a scientific theory. The operation as reported by Delpech, was in general received unfavourably. The editor of a journal of the day, in speaking of it, is astonished that the author *had seriously proposed such an operation.* Other editors were of opinion that it should never be performed, but they discussed the point scientifically and in a becoming manner.

Many years had elapsed without any attention being paid to the subject by operative surgeons, when suddenly there appeared in Rust's journal,[3] a memoir of Dr. Louis Stromeyer, surgeon to the King of Hanover, indicating a new process of operating the section of the tendo Achillis, in the treatment of club-foot. In this memoir, two remarkable cases, cured by means of his plan of treatment, are related. The first of the two operations was performed on the 28th of February, 1831, and the second, on the 12th of June, 1832. On the 29th April, 1834, M. Stromeyer wrote a letter to the editor of the *Archives générales*,[4] communicating the result of four new cases in which he had operated, three of which had been attended with success.

These happy results obtained by the Hanoverian surgeon, awakened promptly the attention of the Parisian orthopedists: MM. Bouvier and Duval[5] repeatedly divided the tendon, and their success soon surpassed that of Dr. Stromeyer. These, with the remarkable cures that have been obtained by myself, and which I shall presently detail, include, I think, all that has been achieved, up to the present time, in this important department of orthopedic surgery.

The section of the tendo Achillis is henceforth an established fact; it is an achievement of science destined to give new éclat to surgery, by the benefits that those unfortunate individuals affected with deformities of the feet will experience from it.

If we look back to the facts contained in the annals of medicine, we are astonished to find that this important discovery was not made at an earlier period,—a discovery reserved to adorn the nineteenth century. The fact had been established by Molinelli[6] in the

[1] Michaelis, in Hufeland's Journal; anno 1811, 6tes Heft.—This surgeon after all did not make a complete division of the tendon, but only incised it partially.

[2] Sartorius, in Siebold's Journal; 3ter Band.

[3] Rust's Magasin für die gesammte Heilkunde.--39e vol., and Gazette Médicale, Sept. 1833, p. 673. This same memoir, translated entire by Dr. Richelot, will be found in the Archives générales de Médecine, 1834, tome 1er.

[4] Arch. Gén. t. ii. p. 194,—1834.

[5] Bouvier.—Mémoire lu à l'Académie des Sciences, séance du 12 Sept. 1836, et Académie de Médecine, 26 Novem. 1826.—Voy. Bulletin de l'Académie de Médecine, 15 Décem. 1836. Duval.—Académie royale de Médecine, 17 Janvier. 1837, Bulletin, Janvier, 1837, p. 304.

[6] Comment. Academ. Scientiar: Bononiens. t. ii, par. 1. page 189—196, and memoirs to serve as a history of the 18th century, by Paul Avignon,

history of the Academy of Bologna, that contrary to the generally received opinion of that period, wounds of the tendo Achillis would heal with facility. He reports four cases in which the tendon was cut transversely, and notwithstanding the wounds were complicated, they healed kindly. Hoin,[1] an expert surgeon of Dijon, with a view of establishing the fact, instituted a series of experiments, the result of which was in perfect accordance with what had been stated by Molinelli. He divided both partially and wholly the tendo Achillis of cats and dogs, and although the animals were left entirely to themselves, and no precautions taken to exclude the air, all the wounds healed perfectly.

In order to complete our history, we may add that the division of tendons for the purpose of curing distorted members, is a fact which has been for a long time known to veterinary surgeons. I have even been assured that in Limousin[2] the operation is frequently performed, and by the most ignorant men, those wholly strangers to science. See an extract from a publication of MM. Miquel and Debeaux[3] in 1826.

"It is long since the practice of dividing the flexor tendons of the feet, in cases of vicious inclination of the members, was adopted, although no one has as yet been at the trouble of prescribing precise rules for performing the operation methodically. Probably timidity in some, and want of success in others, has heretofore prevented veterinarians from making known their operative process. We know that some practitioners succeeded by this means, and long before ourselves, in restoring limbs which had altogether lost their perpendicularity. Our object in communicating the result of our labours is to simplify and render more familiar, an operation which may prove to be as advantageous to *human surgery*, as to that of animals."

We will but remark, with regard to the above passage from the memoir cited, that human and veterinary surgery are so nearly allied in some respects, that they frequently progress hand in hand towards discovery, and that notwithstanding certain pretensions, it would be a thing almost impossible to discover to whom belongs the credit of having been the first to form the idea of dividing the tendo Achillis. But we again repeat,—this is not the most important point; the idea is essential and even indispensable, but the true founder of a method is he who lays down the rules to be followed, and points out the cases where it is applicable.

Notwithstanding the astonishing success following the division of the tendon, M. Jules Guérin is of opinion that the operation may be entirely dispensed with in the cases of very young children, and softened plaster substituted in lieu of the present containing appa-

[1] Journal de Médecine, Janv. 1769, pp. 56—78.

[2] [Lately a French province. Transl.]

[3] Observations on club-foot; Journal pratique de Médecine vétérinaire, Paris, 1826; p. 202; and same journal, 1828, p. 283, observations of M. Blanc, and 1830, p. 246, Obs. of M. Bouissy.

ratus. This is only a new application of the plaster which has been for some time in use in Germany, in the treatment of fractures.[1]

The following is M. Guérin's process. The deformed member having been previously smeared over with some oleaginous substance, and surrounded with a roller bandage of flannel, is properly placed and suspended on transverse bands in a carved splint; the foot is then subjected to an opposing lateral extension, the object and result of which is to produce torsion and reversion in an opposite direction to the existing torsion. Plaster is then poured around the member, which is kept in a fixed position until it hardens. As soon as it has become completely solidified, the limb is removed from the splint, and the envelope cut with a knife, so as to leave one layer of plaster only, of the thickness of three or four lines, around the leg and foot. This dressing is renewed every eight days.[2]

M. Jules Guérin exhibited to the Academy several young persons whom he had succeeded in curing by this plan of treatment.

We have now completed the exposition of the different modes of treatment which have been employed for combating deformities of the feet. We have done this in the character of a reciting historian, and not as a judge. This latter character we shall assume hereafter, when we have to appreciate the value of the respective methods employed for treating club-foot.

Let us now devote our attention to the pathological anatomy of the diseased organs.

ANATOMY OF CLUB-FOOT.

I reject from the historyof this complaint, every accidental deformity whether occasioned by a general disease, or the result of accident. It appears to me to be a singular error to arrange in this class, distortion of the feet brought on by rachitis, gout, rheumatism, white-swelling or a luxation badly reduced or not reduced at all.

The talent for description, as evinced in the work of Scarpa,[3] cannot be too much admired. It is truly to this illustrious professor, that we are indebted for our first precise notions with regard to the pathological alterations presented by the disease. If new researches have made known some omissions, and detected a few er-

[1] Professor Dieffenbach has often used this plaster, and one of his pupils has published a dissertation on the subject entitled, "De cruribus fractis gypso liquefacto curandis." Joan. Aug. Muttray. Berolini, Sept. 1831.

[2] Letter sent to the "Académie royale de Médecine," 19th April, 1836.—Gazette Médicale, 23d April, 1836, p. 268.

[3] Op. cit.

rors,[1] it must still be admitted that his work has served as the basis of such anatomical descriptions as have lately appeared.[2]

If in the present state of our knowledge, we cannot affirm that the causes which give rise to congenital club-foot are identically the same with those which occasion the accidental variety, we must nevertheless admit that there is the greatest analogy between their effects. I have frequently compared the limbs of children, some of whom had been deformed form birth, and others by accident; and it has always been impossible for me to detect their distinctive characters. What remarks, then, we may have to make on the one, will most generally apply to the other also.

Accidental club-foot is almost invariably occasioned by convulsions, or a chronic inflammation of the tissues, and in some rare cases by a defect of innervation in the spinal marrow. Whatever may be the exciting cause, the following is the progress of the disease.

A month or two after an attack of convulsions, the tendo Achillis becomes stiff and prominent, and the point of the foot is depressed with difficulty. This state of things may continue for a long time without becoming more aggravated. It lasted for more than a year in the case of an interesting little girl of eight years of age, who became paralytic after an attack of follicular enteritis. Finally the calf of the leg becomes atrophied, or rather, it is not developed proportionately with the other muscles of the body. The belly of the muscle being short and thin, the tendinous portion appears to be longer than it naturally should be. These appearances are very perceptible in children who are afflicted with but one club-foot. The contraction of the tendo Achillis, causes the elevation of the calcaneum in a direct manner, and if this elevation is to the extent of half an inch,—and it is sometimes several inches without lateral deviation,—it constitutes our *phalangian* variety of the disease. Most frequently, however, as the malady becomes more and more developed, the posterior edge of the calcaneum is forced to take an inward turn,[3] the inner edge of the foot scarcely touches the ground, and this is the period when, if the child is allowed to walk, the weight of the body increases the deformity.

The external ligament of the tibio-astragalian articulation becomes elongated, the astragalus and scaphoides are drawn along with the calcaneum, to which they adhere by powerful ligaments; the back of the foot becomes convex; the sole concave, and furrowed by numerous transverse and oblique wrinkles. The big toe is separated from the others, and turned towards the inner edge of the foot. The plantar aponeurosis becomes contracted, and the muscles of the foot which are inserted into it draw the toes backwards;

[1] Cruveilheir, Anatomie-pathologique du Corps humain; 2e livraison, Paris, 1830.

[2] Dissert. sur le Pied-bot, par Ch. Help. Strasb. 20 Juin, 1836.

[3] See plate ii.

at the same time the superior metatarso-phalangian ligaments become elongated, and the foot is nearly folded in two.[1] In this deplorable condition, children walk on the external edge, and sometimes on the back of the foot. The part on which they rest their weight becomes hard and callous, whilst the subjacent cellular tissue gets thickened; it still, however, preserves its softness and elasticity. It is not uncommon for mucous bursæ to form in it. The leg and thigh generally preserve their natural form, but it is not rare to find one or the other knee inclined more or less inwards or outwards, the tibiæ bent, and the malleolus internus imperfectly developed. When both feet are deformed, their points touch, and often overlap each other; the patient experiences great difficulty in walking, is obliged to raise his feet alternately, and to carry the one above, and in advance of the other, so as to be constantly describing a semicircle. Falls are consequently very frequent, and in order to avoid them, the child, when he walks, keeps his body in a constant state of agitation, he seems to be always seeking his equilibrium. Frequently the trunk is carried slightly forward, whilst the pelvis is thrown backwards. In the *calcanian* variety of the disease, this position is inevitable, and is occasionally very decided. The weight of the body, and badly designed or ill-constructed shoes, frequently occasion inflammation and ulceration of the compressed parts. These ulcerations are interminable;—the osseous tissue becomes swollen, and oftentimes carious; the leg is completely atrophied, and abscesses form in it, which eventually open and suppurate ad infinitum. Rest may remedy a portion of these evils, but they are sure promptly to reappear under the influence of locomotion.

The *phalangian* and *calcanian* variety of club-foot are attended with fewer evil consequences than the others.

Let us now see what are the changes discoverable by a dissection of the diseased parts. To commence, let us examine the pathological anatomy of inverted club-foot. On elevating the skin, we are first struck with the atrophied condition of the muscles, particularly the gastrocnemius and soleus; the fibres of the muscles will be rarely found to extend lower down than half of the tibia, whereas in a normal state they descend at least two-thirds of the way. The tendo Achillis is long, tense, and attenuated comparatively with the age of the patient; the superior aponeurotic portion is especially remarkable for its tenuity. The muscles are frequently found to have degenerated into a soft fatty state. The cellular tissue is condensed and small in quantity. No trace of adipose matter is to be found in the legs of many individuals, unless it be on the sole of the foot. The nerves are, according to my own observation, reduced in size, and the arteries are evidently so. The posterior tibial artery is nearer to the internal edge of the tendon, especially in young children, than it is in a normal state. In many

[1] See plate ii.

subjects I have found it to be very superficial,—an important circumstance, which should always be borne in mind when the section of the tendon is practised. In ancient cases of the disease, the foot is always slightly atrophied,—it possesses neither its normal length nor breadth.

The bones of the tarsus do not bear their natural relation either to each other, or to the tibia. Many authors have thought that they were frequently luxated; Hippocrates, however, did not partake of this error.[1] It was reserved for Scarpa to prove conclusively that such was not the case. The bones—as he has most clearly shown, are only separated partially from their mutual contact, and twisted around according to their antero-posterior axis. This is particularly observable with regard to the calcaneum, cuboides, and scaphoides; less so in the case of the astragalus. This disposition is such that none of these bones abandon entirely their articular cavities.

There is an exception, however, presented in the case of a fœtus at term, deposited by Professor Ehrmann in the Museum of Strasburg, and which was dissected by M. Held.[2] In this case the astragalus is completely luxated forwards and inwards; its position is transverse to, and it is situated in advance of, and below the bones of the leg; its posterior edge is in contact with the inner edge of the malleolus externus; its anterior extremity has become internal, and terminates at the surface of the external face of the malleolus internus of the tibia; its antero-superior surface has become inferior, whilst the inferior is superior. The astragalus here, then, experiences a double luxation,—the one forwards and downwards, and the other inwards with a slight inclination backwards. The second luxation is the cause of the anterior extremity of this bone becoming internal, and its trochlea inferior. The calcaneum has undergone the same change of position as the astragalus. The calcaneum and scaphoides are the two bones of the foot which experience the most decided deviations; the posterior extremity of the calcaneum, being drawn forcibly inwards and upwards, twists in the direction of traction. Its superior surface looks towards the outer side of the foot; the cuboido-calcanian articulation opens, especially when in the act of walking, and the internal ligament which unites so firmly the calcaneum to the astragalus, draws the latter bone inwards by throwing its articular surface outwards. Nevertheless, with those children who have walked but little or not at all, the astragalus, when compared with the other bones, will be found to have deviated but slightly; Scarpa even notices this fact. At a more remote period, however, the astragalus becomes involved also.

As the facts stated by the Pavian Professor are in perfect accordance with what I have met with in my practice, I have admitted

[1] De articulis, loc. cit.
[2] Dissert. cit. p. 9.

them as conclusive. I am bound in justice, however, to add that M. Cruveilheir,[1] is of opinion—and this opinion is founded on his own dissections—that the astragalus is, on the contrary, the one of all the bones of the tarsus, which experiences the greatest deformity, and that there is not only a change of direction, but also a change of form. The astragalus, says he, is generally diminished in volume, it is occasionally atrophied, and in every case it is deformed.

The scaphoides, the cavity of which receives the articulating surface of the astragalus will be found so turned on its own axis that its inner tuberosity, which in a well formed foot is situated nearly horizontally, is carried obliquely upwards, close to the malleolus internus, whilst the external tuberosity looks obliquely downwards,—a position which is the more marked in proportion as the outer edge of the foot rests on the ground, and the point is brought back inwards and posteriorly. The consequence of this mal-position is, that the head of the astragalus being no longer received into, or wholly covered by the scaphoides, forms a very distinct projection on the back of the foot.

The three cuneiform bones, the bones of the metatarsus, and the phalanges of the toes, follow necessarily the vicious deviation of the scaphoides, cuboides, and calcaneum. The superior ligaments belonging to the articulation of the three cuneiform bones with the scaphoides are drawn out and elongated, so as to admit of a separation of the bones superiorly, whilst inferiorly the articular surfaces are pressed together, and thus the developement of the bones is prevented.

The deformity of the bones of the foot varies necessarily according to the period at which circumstances may admit of an examination of their pathological condition.

But the principal derangement of the bones in cases of *inverted club-foot*, consists of a more or less decided torsion of the calcaneum, cuboides and scaphoides—involving the astragalus and the bones of the metatarsus, and toes.

Deviations of the bones of the foot give rise to very perceptible changes in the length of the muscles. The tendons of the peronei become elongated, as also those of the extensor communis digitorum pedis, and the extensor proprius pollicis pedis. The tibialis anticus becomes shortened, the flexors of the toes, the tibialis posticus, and the gastrocnemius and soleus muscles are sensibly diminished in breadth.

The organic derangements occasioned by *everted club-foot* are not so decided as those caused by the *inverted* variety—at least, I have noticed this to be the case in one instance furnished by my practice. It would at once be thought that the position of the bones ought to be precisely the reverse of what they are in the case of inversion ; this, however, was not exactly the condition of things in a case—the only one—that I have had an opportunity of examin-

[1] Op. cit. p. 10.

ing. In this instance the calcaneum was slightly elevated above the ground; the position of the astragalus remained unaltered; the articulation of the scaphoides with the three cuneiforms was not at all separated. The scaphoides in turning around from without inwards, had been drawn along by the tendon of the peroneus longus, the insertion of which is at the inferior face of the first cuneiform. The tendons of the peronei muscles, and more particularly that of the peroneus longus, were stiff and tense, and seemed evidently to be the principal cause of the deviation outwards.

The articular relations are but little deranged in the case of *phalangian club-foot*, even when very forcibly developed. I once saw a man of twenty-five years of age, in whom all the articulations of the foot, with the exception of the metatarso-phalangian, had retained their normal position. It is these last, in fact, which bear the whole weight of the body. Gradually the toes become bent, and the heads of the metatarsi are directed downwards: the luxation is now nearly complete, and the bones of the metatarsus form almost a right angle with the toes. Frequently the ligaments of the astragalo-scaphoidian articulation become elongated, and the head of the astragalus projects—or rather, all the articulations of the tarsus yield at once, and the foot becoming hollow, turns inwards, and takes an intermediate position between phalangian and inverted club-foot, and then it is, that the displacements, described in treating of this last variety of deformity, are perceptible.

Calcanian club-foot is occasioned by a powerful contraction of the anterior tibial muscles, the extensor proprius pollicis pedis, and in some instances, by that of the extensor communis digitorum pedis. The tendons form an evident protuberance under the skin; they present the appearance of cords stretched to their utmost, and resist energetically even a very forced attempt at extension. The inner edge of the foot becomes sensibly elevated above the outer, which occasions an oblique surface from before backwards, and from within outwards. The principal point where torsion takes place is at the articulation of the cuboides with the os calcis, and of the scaphoides with the astragalus. The articulations of the cuneiforms, however, are also implicated. As a consequence of these changes, all the articular surfaces of the bones of the tarsus become more or less separated from each other inferiorly; the inner tuberosity of the scaphoides has a tendency to become superior, and all the bones of the foot, with the exception of the os calcis being elevated, no longer touch the ground. In this state the dorsal surface of the foot forms an acute angle with the tibia.[1] Occasionally the point of the foot is slightly inclined outwards in consequence of a powerful contraction of the extensor communis digitorum pedis. It has appeared to me that this variety is attended with a

[1] See plate v.

greater degree of atrophy of the leg, than any of the other forms of the disease.

All the cases of calcanian club-foot that have come under my observation were congenital; at first they were trifling, but the deformity increased with the age of the patient. The knowledge of the foregoing anatomical and pathological facts will soon enable us to establish such rules as are indispensable for obtaining a radical cure of the malady.

ETIOLOGY.

What are the causes that give rise to the developement of club-foot? This is an important question, and one which has received various explanations. Ambrose Paré[1] has no hesitation in asserting that the deformity is occasioned by the mother's remaining for too long a time seated with her limbs crossed; or the nurse in carrying the child, by too long pressure from retaining it in one position, occasions the turning of the feet. Benjamin Bell[2] admits that a mal-formation of the articulations may occasionally give rise to the disease, but he considers this as a very rare cause. He is of opinion that the contraction of the muscles most frequently occasions it. But the chief cause, according to this author, is the form of the leg. "When it is curved outwards," says he, "the toes are inverted, and the side of the foot is turned under, or, if the curvature of the leg be considerable, nearly the whole sole of the foot will be turned upwards, and at every attempt at locomotion, the instep will press on the ground; when, however, on the contrary, the bones of the leg are curved inwards, the toes and sole of the foot will be thrown outwards and upwards." This is an error on the part of Mr. Bell, which is proved by every day's experience; it is quite common to meet with men having their limbs singularly distorted inwards and outwards, whose feet present none of the characters of club-foot.

Duverney[3] thought that the deformity was caused principally by an unequal degree of tension of the muscles and ligaments; "for," says he, "as these muscles and ligaments are so preternaturally stretched, they draw the foot towards them, whilst the opposing muscles and ligaments being to a certain extent in a state of relaxation can do naught, and are compelled to yield to whatever vicious direction the foot may take." This, we think, is looking at one side of the question only: it is, however, an important step towards the truth. Scarpa having congenital deformities only in view thinks

[1] Op. cit. p. 578.
[2] Cours complet de chirurgie, trad. de Bosquillon; tom. vi, page 168.
[3] Traité des maladies des os; tom. ii. chap. 3.

that Duverney is in the wrong, and that he mistakes the effect for the cause. Scarpa admits that the twisting of the bones of the tarsus is the first of the series of accidents, and that there results from it an approximation of the insertions of some muscles, and a separating of those of others from their point of attachment, and consequently a shortening of the first, and elongation of the second. He adds—"this defect of equilibrium between the two classes of muscular powers, which has just been indicated, contributes in a great measure to keep up the deformity arising from congenital-inverted club-foot, which increases proportionately as the patient advances in life. The action of the peronei muscles not being sufficient to counterbalance that of the two tibiales, the tibialis anticus especially,—these last are constantly dragging the body of the foot more and more upwards and inwards. Hence it is that the combined strength of the four above named muscles, not being sufficient to establish an equilibrium with the muscles of the calf of the leg, the tendo Achillis is necessarily kept on the stretch, and the tuberosity of the calcaneum into which it is inserted, is in the act of being constantly drawn upwards in an oblique direction, and from within outwards from the calf of the leg. Finally as the child advances in age and walks, the weight of the body presses more and more on the external edge of the foot."[1]

Thus, according to Scarpa, the primitive cause of the deformity is the peculiar conformation of the articular surfaces; the displacement and consequent contraction of the muscles being only secondary. This idea, if meant to convey a fact merely, is correct, but if adopted as a positive principle, it is certainly an error, and we are surprised at its having been committed by the expert anatomist who had just made known to the medical world the effects of the deformity in the disease, by proving from actual dissection, that displacement alone of the bones, without ever extending so far as luxation, constitutes the principal pathological derangement observable in the malady. How could he in fact account for the disease ever being accidental, by admitting, as the principal cause of the deformity, a deviation of the articular surfaces? Wrapped up in this error, it was impossible for him to account for the atrophy of the leg, an invariable condition to the complete formation of the disease! "Most generally," he says, "the leg is well formed, but thin, especially about its middle: it is not nourished proportionately with the rest of the body, and it appears to me impossible to give a plausible reason for this phenomenon. Can that condition of things which demands a reciprocity of harmony and connection between the parts as necessary to their perfect developement and growth, notwithstanding the acceleration of the circulation, and the distensible faculty possessed by the smaller vessels, be considered as sufficient? For it has been clearly proved that the want of exercise alone has no perceptible influence in inducing atrophy in

[1] Op. cit. p. 130, 131.

such cases, since experience has shown that this part (the leg) has grown, become fully developed, and strong, in children who have been kept in a perfect state of quiescence during as many months as the treatment may have continued."[1] This candid and frank confession of one of the greatest geniuses of modern surgery is greatly to be admired, and if we are not so reserved ourselves, it is because we consider that we are authorised by the increase of medical knowledge, and the desire of contributing one step to the advancement of science, to speak more decidedly. We shall soon venture to hazard our own explanation.

Delpech was better acquainted with the causes productive of the disease; he believed them to differ according as the malady was congenital or accidental. He thinks that accidental club-foot arises from muscular contractions, which are almost invariably occasioned by inflammatory action. In congenital club-foot, he considers the condition of the muscles as very different; so far from possessing that exuberance of vitality which belongs to them in the former case, they are dried up and withered—nutrition in their case is languid, and so far from assisting in the cure of the necessitous deformity, they rather contribute to its augmentation.[2]

Here is evidently a step gained—experience has been consulted, and the penetration of Delpech has discovered a part, at least, of the evil. This wise example would seem worthy of imitation, but this, I fear, will never be the case—direct observation will be abandoned, and indulgence given anew to theories which may be curious, indeed, but which will be found to be established on too weak a basis, to stand the test of a serious examination.

During the sitting of the Royal Academy of Medicine of Paris,[3] of the 26th November, 1836, M. Martin, surgeon orthopedist, recurring to an opinion often conceived, but always abandoned, and yet again renewed lately by M. Cruveilhier,[4] advanced the idea that the cause of the deformity in congenital club-foot is an absence of the liquor amnii; he brought forward, in support of his opinion, a series of curious cases. The following are the principal facts on which he relies for the support of the theory.

A child which had been born with both feet inverted, having been sent to him by Dupuytren, M. Martin was surprised to see it double itself up spontaneously, and assume the ovoidal form which it had presented in the cavity of the uterus; the thighs were flexed on the pelvis, and the legs on the thighs; the feet came voluntarily to apply themselves to the buttocks, and to cross one over the other in the form of club-foot; this spontaneous doubling was, according to M. Martin, a detection of nature, in the act of forming the disease. The mechanism of this deformity was to him as a ray of

[1] Op. cit. p. 113, 114.
[2] Orthomorphie, vol. ii. p. 322–325.
[3] Bulletin of the Academy, 15th November, 1836.
[4] Op. cit. p. 7.

light, for, evidently, it was the result of a direct pressure exercised by the uterus on the pelvic extremity of the fœtus.[1]

The author introduced this case, with sixty-one others, in defence of the theory. He proved that in every case there was a relative absence of the liquor amnii during some period or other of the pregnancy—that in consequence of such absence the womb exercised a direct pressure on the feet, and deformed them; that unvarying symptoms announced, during gestation, the existence of the deformity in question; that women uniformly experience about the fifth or sixth month, sometimes even later, a fixed and almost insupportable pain in the epigastrium, when the child occupies the vertical position; and in the hypochondriac region, when its position is transverse; which pains M. Martin refers to the pressure of the child's feet against the parietes of the womb; that constantly, also, the women complain of a troublesome weight on the perinæum and fundament; that the abdomen is generally smaller than in normal pregnancies; that if—what would appear contradictory—the birth of club-footed children is occasionally preceded by an abundant discharge of the liquor amnii, this fact is to be accounted for by the probability of the fluid's having been secreted in a large quantity only at a very late period, whereas, up to the eighth, or even ninth month, the quantity had been but small, and the reversion of the feet had already been effected prior to its increase; that, agreeably with this theory, twins should be more exposed to the accident than single-born children—a fact proven by experience.

All these theories appear to me to be incomplete and unsatisfactory, inasmuch as but one, or at most very few cases are adduced, from which general principles are drawn. If it were otherwise, why is the formation of accidental club-foot invariably overlooked? The fact is, it is neglected, because the mode of its developement is never in accordance with the system proposed; it is, however, of such frequent occurrence as to require that it should be taken into consideration.

In my opinion, it is impossible, in the present state of our knowledge, to establish any theory, which, embracing all the known facts, shall account satisfactorily for the formation of the disease. I believe that no such theory can ever be established, for the diversity in the causes which occasion deformity of the feet must, we think, ever prove an insurmountable barrier to the discovery of any single principle for the government of the whole.

Let us now proceed to examine some cases. Eugène G—— was born in the month of May, 1836, with a slight deformity of both feet; so trivial was it, that it was capable of being rectified by the least manual effort, and occasionally the contraction of the anterior muscles of the leg alone would suffice to restore them to their normal position. The child's relatives paid great attention to the

[1] Bulletin, &c., sitting of 3d June, 1838.

deformity, and took every precaution for obtaining its rectification, but all to no purpose; the feet became daily more and more distorted, and the tendo Achillis was stiff, and protruded under the skin. Although a very strong child, it was unable to walk at the age of twenty-one months:—when it stood up, the feet invariably turned on their outer edge, and the heel abandoned the ground. I divided the tendo Achillis of both feet, and they instantly assumed their normal position; in fifteen days after the operation, the cure was complete.

What does this case prove? If I am not much mistaken, it shows that here there was an inequality of force between the flexor and extensor muscles of the feet, and that the gastrocnemii, being the most powerful, drew the heels upwards. To obviate every objection to my explanation, it must be borne in mind that all the muscles of the leg were well developed—there was not the slightest appearance of atrophy. If it is argued that, in this case, the deformity was occasioned by a primitive obliquity of the articular surfaces, I should like to know how the fact of the feet having been so easily reduced can be accounted for, and how, if it was, they retained their normal position after the section of the tendon.

There can be no doubt, then, but that the deviation in the above case, is solely attributable to an inequality of strength between the extensor and flexor muscles.

A young girl, named Ida Auvert, whose case will be found reported at length further on, was born with a club-foot of the right side; so great was the deformity at the time of birth, that her relatives, deeming it incurable, disregarded it entirely. When I saw her, there was apparently no heel, the astragalus was forcibly thrown outwards, and the scaphoides also, insomuch that its inner tuberosity, which had become superior, caused a protrusion under the skin. All attempts, even the most forcible, were insufficient to reduce the foot to its normal position; even after the division of the tendon, it could not be immediately rectified. Do not these facts prove that the deformity, in this case, was principally owing to a vicious disposition of the articular surfaces?

What influence has the position of the fœtus, as asserted by M. Cruveilhier, or its compression by the uterus, as MM. Stoltz[1] and Martin think, over the formation of the congenital variety of the disease? I think it possible, and when I look at the cases brought forward by the above authors in defence of their opinions, and the figure represented in the work of M. Cruveilhier,[2] I must allow both these causes to be of the number of those capable of contributing to the production of the disease. But to admit them to be the sole causes, and attempt by them to account for the formation of every variety of the disease, would be a gross error. M. Cru-

[1] Memoir on a peculiar species of club-foot.
[2] Patholog. Anat. plate 11, fig. 1, 2d book.

veilhier[1] undertook to refute the assertions of M. Martin, and—what is worthy of notice—a part of his objections may be urged against the system which is defended by himself, and which, after all, differs but slightly from that of M. Martin. "Is it clearly proven," says M. Cruveilhier, "that in every case of club-foot, there has been a deficiency of the liquor amnii. Has it not, on the contrary, been shown that in a large number of dry accouchements, as they are termed, the children have been born perfectly formed? Whilst, on the other hand, club-footed fœtuses have been seen surrounded by a very large quantity of the fluid." Nearly all the cases adduced by M. Martin were successively examined, and discredited by M. Cruveilhier.

Notwithstanding Cruveilhier's objections, we still think that the position of the fœtus in the womb, and a diminished quantity of the liquor amnii may be admitted among the number of causes productive of the disease.

There is yet another and fourth cause which may occasion congenital club-foot, viz. convulsions of the fœtus in utero. I have, on several occasions, seen children born, having their muscles wasted away and contracted, and which still seemed (at the time of birth) to be in a state of spasm. In some instances the feet, and occasionally the hands, were found to have deviated so much as to present all the characters of the disease under consideration. In the cases of many of them, the intellectual faculties remained in a state of torpor, approaching almost to imbecility, whilst the deformity of the feet, which at birth was imperceptible, or very slight, became developed with age. The following is a remarkable example.

G——, of a village in the neighbourhood of Metz, was born with a deviation of the feet, so slight as scarcely to be noticed. The child was thin, and of a diminutive stature; its intelligence did not progress with its age. By degrees the anterior muscles of the leg became contracted, and the tendons of the tibiales antici, and of the extensors of the toes, protruded perceptibly under the skin, which was elevated by them; the toes themselves became straightened, and were raised from the ground—all the bones of the tarsus were successively lifted up, and by the time that the child had attained its tenth year, the progress of contraction had rapidly increased; the feet formed very acute angles with the tibiæ, and it ended by becoming a confirmed case of club-foot.[2] The patient experienced the greatest difficulty in controlling the motions of the thoracic and pelvic extremities, which were kept in a constant state of agitation by the involuntary contractions of the muscles.

Does not the foregoing case prove the influence of encephalic and rachidian nervous disease over the developement of club-foot? The younger brother, also, of the child above mentioned, evidently stronger and more robust, was perfectly well formed at the time of

[1] Bulletin of the Royal Academy, Nos. 18 and 19, July, 1838.
[2] See plate 5.

birth—he continued so for seven years, and retained excellent health; within the last two years, however, without any visible or appreciable cause, the gastrocnemii muscles became contracted, and the os calcis ceased to touch the ground, whilst the feet were inverted. The right foot was found to have deviated rather more than the left. I operated on this child, and he is now completely cured.

The above cases give rise to a number of reflections. Is it not very remarkable that in that of the congenital calcanian club-foot, the disease should have increased so rapidly at the age of ten years, and that in the case of the other brother, with the inverted variety, it should have appeared, and become fully confirmed after a lapse of years, and that too without any known cause? Was it a chronic irritation of the muscles of the calf of the leg which caused the pathological change? Or, was it the result of morbid innervation?

These are questions difficult of resolution, and prove, in my opinion, that much yet remains unknown as to the etiology of the disease.

Accidental club-foot is frequently occasioned by infantile convulsions. At first, the deformity is slight, but it increases with the age of the patient, and may, as in the case of the congenital form, become highly aggravated. It is remarkable that convulsions seldom occasion the deformity of but one of the feet, and that if it happen in the case of children of four or five years of age, the cure will be more easily accomplished than if it had taken place at an earlier period. This difference is occasioned by many evident causes.

With these cases before us, is it not admissible to think—what we have already stated—that the fœtus experiencing convulsions *in utero*, congenital club-foot may arise under the influence of this cause? Although direct observation has not proved such to be the case, analogy would lead us to suppose that it should be so, and I have no hesitation in admitting it.

It finally remains for me to indicate a case reported by Delpech, of club-foot consecutive to a retraction of the plantar aponeurosis;[1] a remarkable, and as yet unique example.

On resuming the facts presented, we find that congenital, or accidental club-foot may be occasioned—

1st. By an inequality of force between the extensor and flexor muscles of the leg and foot.

2d. By an anormal position of the articular surfaces.

3d. By a mal-position of the fœtus *in utero*.

4th. By the pressure of that organ on the thin flexible members of the child.

5th. By convulsions *in utero*.

6th. By convulsions during early childhood.

7th. By a chronic inflammation of the muscles of the leg.

[1] Orthomorph.

8th. By defective innervation of the tibial nerves, caused by disease of the encephalon, or spinal marrow, without previous convulsions.

9th. By the contraction of the aponeurosis plantaris.

10th. By muscular contraction without any appreciable cause.

We must add to the above, the fact that club-feet often exist in monstrosities, and in some persons whose intellectual faculties are but imperfectly developed.

If we look for an explanation of the changes of nutrition brought about in limbs affected with this disease, we shall find it to be principally owing to a diminution in the caliber of the artery, which in some ancient cases has been found to have lost as much as two thirds of its diameter. This obstacle to the access of the reparative fluid accounts satisfactorily for the atrophy and diminished temperature of the diseased limb.

It has moreover been proven by M. Guérin that in all deformities of the osseous system, the arteries instead of adapting themselves—as is the case with the muscles—to the shortening of the space which they traverse, and running in a straight line along the chord of the curvature, adapt themselves to the curvatures, and follow them, or in cases where they are free, become more and more flexuous, in proportion as the distance, which they have to traverse, is more or less reduced. This fact is sensibly evident in cases of spinal deviation, and curvatures of the members. It is also worthy of remark that on the surface of the convexities of the arterial inflexions, the parietes of the vessels are almost invariably dilated.

The venous system is subject to the same laws that govern the arteries, as far as change of direction is concerned.

But M. J. Guérin has indicated a very important general fact with regard to it, which is—its marked preponderance, an increase which is general in all subjects labouring under strong and ancient spinal deviations, and local in deformities, arising from luxated members, or club-foot. The venous system is subject in all such cases to an increased developement, evinced either by a direct and general augmentation of the size and number of the venous vessels, or by the violet-like colour of the parts, where such increase has taken place. These facts with those relative to the reduction of size of the arteries, and the want of the power of hæmatosis in individuals labouring under spinal deviations, account, M. Guérin thinks, for the oily degeneration perceptible in all the tissues of such individuals, and also for the partial adipose transformation of parts suffering under partial deformities.

With regard to the muscular system, M. Guérin has been enabled, after repeated examinations, to establish as laws belonging to the diseased organism

1st. That in all deformities of long standing, the muscles instead of retaining their primitive relation with regard to the deformed portion of the skeleton, tend to contract, and hold a straight course between their points of insertion.—2d. That the transformation of

the muscles is either oleaginous or fibrous; oily when they are compressed and rendered inert; and fibrous where they are subjected to powerful traction.[1]

I shall conclude this chapter with a statistical enumeration of club-feet.

M. Bouvier[2] reports eighty cases either as having occurred in his own practice, or collected from various authors, out of which number two-fifths were double; one third were of the left foot, and a quarter of the right; out of sixty of these cases three-fifths were boys, and two-fifths, only, girls. Of sixty-one cases collected by M. Martin, twenty-six were double, and thirty-five simple; of the latter, eighteen were of the right, and seventeen of the left foot; as to sex, forty-five were boys, and sixteen girls. From this fact, M. Martin concludes, in opposition to the statistics furnished by Bouvier, that the deviation of the right foot, instead of being less frequent than that of the left, is on the contrary a little more so, and that if the proportion of boys is greater than that of girls, it is because they are generally much larger, and for that reason more exposed (according to the etiology of M. Martin) *ceteris paribus*, to the pressure of the womb. Of thirty-one cases collected from various authors by M. Held, the disease was nineteen times double; twice, more decided on one leg than on the other—and in one instance there was on one leg the inverted, and on the other calcanian club-foot.

Twenty-one cases have come under my own observation, thirteen of which were boys, and eight girls; nine of them had both feet deformed; out of the twelve subjects who had but one foot diseased, seven were of the right, and five of the left foot. The disease was fifteen times congenital, and six times accidental. I have never met with a case of double club-foot that was accidental.

With such contradictory results furnished by partial statistics, it must be acknowledged that science is not as yet possessed of a sufficient number of cases, to establish general laws with regard to the forms of the disease, and its relative frequency in the two sexes, either when one or both feet are affected with the deformity.

Is the disease now under consideration capable of becoming hereditary? In the present state of the science we are not authorised in affirming such to be the fact—but the following cases may be adduced in favour of such a supposition.

At Mardigny, in Switzerland, four brothers of the name of Vaullion, whose history is given by M. d'Ivernois, were all born with the feet twisted inwards.

M. Helt, also, speaks of a family living in the environs of Lauterbourg, which numbers six children, all of whom were afflicted

[1] Extract from the report made to the Royal Academy of Sciences, by M. Double, 21st August, 1837.

[2] Dict. de Méd. et Chirg. prat. art. Pied-bot.

with a congenital torsion of the feet. Here the disease was evidently hereditary, or at least it may be supposed so, as one of the parents was afflicted with the same deformity. I have already cited the cases of the two brothers G..., one of whom presented two calcanian, and the other, two inverted club-feet; there are two sisters, however, belonging to the same family, in whom no deformity is as yet perceptible. On the other hand, however, I know many fathers of families, who have either congenital or accidental club-feet, and whose children are perfectly well formed. There is a man of fifty years of age, now living in the town of Metz, both of whose feet are horribly distorted inwards, and who has nevertheless two perfectly formed daughters.

SURGICAL ANATOMY.

The surgeon who proposes practising the section of the tendo Achillis should devote his most careful attention to the tibio-tarsal region. The most serious accidents may result from a neglect of the anatomical relations of the parts. A large artery and important veins are likely to be wounded during the operation, unless it is performed with every precaution that prudence would prescribe.

But to return to our subject. We limit the tibio-tarsal region to all those parts placed from the distance of one inch above the malleoli, to the tarso-metatarsal articulations. This region regarded as a whole, presents on the inner side—1st, the malleolus internus, and above, and in advance of its point, a hollow which separates the tendon of the tibialis posticus from that of the tibialis anticus. 2d, on the outer side, the malleolus externus, separated from the back of the foot by a hollow which corresponds to the astragalo-calcanian excavation; that part behind, and inferior to the malleolus is prolonged into an apophysis, behind which the tendons of the lateral peronei muscles play; still further back, the tuberosity formed by the external face of the calcaneum will be perceived. 3d. In front, the instep is more or less convex, and there is nothing remarkable except the ridges formed by the tendons of the extensors of the toes. 4th. Posteriorly the skin is pushed backwards by the tendo Achillis, the protrusion of which occasions two lateral grooves or gutters, varying in depth according to the age of the patient, his embonpoint, and the degree of tension of the tendon. The skin presents even in this short space, very notable changes. Fine, thin, and but slightly elastic on the malleolus internus, it becomes quite thick on the instep, and in adults presents transverse wrinkles; large veins are distributed over, and colour it; near the malleolus externus it becomes more supple and elastic; the bed of

cellular tissue on which it rests, permits with great facility the immediate reunion of wounds of small extent—an important fact, and one to which we invite the most serious attention. At the posterior extremity, the skin becomes thickened and stiff, and that part about the calcaneum is often covered with callosities. The internal saphena vein and the nerve of the same name cling to the malleolus internus at a short distance from the tendon of the tibialis anticus; the vein even rests on this tendon, when it gets as high up as the articulation of the scaphoides with the first cuneiform. The malleolus has inserted on its front the extremity of the anterior annular ligament of the tarsus. The internal annular ligament arises from its posterior margin, and goes to be inserted into the inner tuberosity of the os calcis. This internal annular ligament, the continuation of the tibial aponeurosis, converts the tibio-calcanian interstice into a complete vault, and thus confines the tendons, vessels and nerves which pass from the posterior tibial region to the sole of the foot. This vault is divided by a partition which converts the posterior interosseous fossa into a canal. Its anterior portion is likewise divided into two, by a second partition very short and thick. The posterior one, the larger and much the less solid of the two, encloses the flexor proprius pollicis pedis, and the *posterior tibial vessels and nerves.* The anterior one, a very solid osteo-fibrous canal, is still further subdivided into two adjoining grooves, the one for the tendon of the flexor communis digitorum pedis, which is situated posteriorly, and the other for the tibialis posticus, which is in advance, and presents the appearance of being glued to the posterior face of the malleolus.

If it should so happen that the tibialis posticus should by its contraction offer any impediment to the foot's resuming its natural form, care must be taken not to divide it immediately at the back of the malleolus, for, at that point the tendon is enveloped in a fibrous sheath lined with synovial membrane—and a wound of these parts would almost inevitably be attended with serious inflammation which might be transmitted to the synovial capsule of the articulation. The only point, then, where it would be safe to divide this tendon, is immediately above the malleolus. This is an operation, however, which has never as yet been found necessary. The disposition of the parts is such, that it seems to me impossible that a section could be made of the flexor pollicis pedis alone, unless it should protrude so much under the skin as to render it readily accessible to the bistoury.

On the instep, the slightest contraction makes evident the tendons of the tibialis anticus, and extensores digitorum pedis. The tendon of the tibialis anticus muscle is separated from that of the extensor proprius pollicis pedis by a cellulo-adipose partition. These two tendons may be divided without danger, as they are not enclosed in a synovial sheath, and the pedal artery besides being deep-seated, is placed on the external side of the extensor proprius pollicis pedis.

The tendons of the lateral peronei muscles will be found situated *behind* the *malleolus externus;* arising from the external face of the fibula, they gradually turn around backwards; the sheath in which they are enclosed appears only to be a continuation of the aponeurotic canal, which kept them isolated on the leg. Having got behind the malleolus, they there hollow out a deep groove or canal, in which they are maintained by a resisting fibrous tissue which forms its posterior partition. Immediately above the malleolus externus, these tendons are placed directly under the skin, and this is the point to be selected in preference to every other for dividing them. It is impossible to avoid cutting the tendons of both the peroneus longus and medius at the same time, as they are too closely united for the instrument to divide one without the other also. This section, however, indispensably requisite in the case of everted club-foot, will be attended with no evil consequence, notwithstanding the presence of some of the muscular fibres which extend along with the tendon of the peroneus medius as low down as the bottom of the malleolus externus.

The vessels belonging to this region are too unimportant to render the operation at all serious. They are the external malleolar artery, some other very small branches of the anterior tibial, and (when they exist at all) the anterior and posterior branches of the fibular artery; the accompanying veins are also unimportant; one only is deserving of being mentioned, viz. the external saphena; having like the internal saphena, come from the back of the foot, it winds about in the sub-cutaneous cellular bed, and passes behind the malleolus to get into the fibulo-calcanian fossa.

The external *saphena nerve* is the only one to be seen in the vicinity of the malleolus externus, and the cutting of its small branches would have no deleterious effect on the success of the operation. The division of the external saphena vein, without being at all a serious accident would be the worst that could happen.

Let us now examine the posterior part of the leg; the tendo Achillis is there made evident by its strength, size, and the manner in which it is inserted into the os calcis—an insertion which occupies only the inferior half of the posterior face of that bone, its upper half being separated from it by a synovial bursa of considerable extent.

At that point where the tendo Achillis becomes detached from the fleshy fibres of the soleus and gastrocnemius muscles, its transverse diameter is generally about ten or twelve lines, varying in different individuals. It soon contracts, however, and presents the appearance of a large and nearly round cord. At the distance of half an inch from the os calcis, the tendon again enlarges, and the flattening of its fibres increases to such an extent as to admit of their embracing the whole of the posterior face of that bone. This is the point where the bursa mucosa is located. If the tendon be examined anteriorly, it will be found that the fleshy fibres accompany it much lower down, than they do posteriorly, the conse-

quence is that that portion of the tendon which is completely isolated, is not more than two inches in length. The knowledge of this fact is very important to the success of the operation, for if you cut too high up, you fall necessarily on the fleshy fibres which may inflame and give rise to dreadful suppurations. If on the other hand, the bistoury be carried too low down, the bursa mucosa may be opened, and the synovia which would escape from it, would offer a serious obstacle to a speedy cure.

In order that the division may be made under the most favourable circumstances, that point must be selected which would correspond with the middle of the malleolus externus, supposing a line to be drawn transversely. The abundant supply of cellulo-adipose lining which surrounds the tendon is a fortunate circumstance, inasmuch as it facilitates a speedy cure ; it forms a true sheath into which are emptied the fluids which are to serve as the medium of reunion between the divided extremities. When the tendon is cut, an interesting phenomenon occurs by an instant opposition being made to the ingress of the air, which is prevented from coming in contact with the tendon ; it so happens that the moment when the instrument divides the tendon, it contracts with force, and draws along with it the adherent cellular sheath, which being pulled from below upwards, closes like a button hole after the instrument. The relation borne by the posterior tibial vessels and nerves to the tendo Achillis merits particular attention. In the adult the posterior tibial artery runs superiorly along the tendo Achillis, from which, however, it is separated by a considerable body of cellular tissue. About the height of the malleolus internus, the artery turns aside to run inwards and downwards, and finally sinks down into the tibio-calcanian fossa. This artery is accompanied by the tibial vein, which most commonly has two trunks, one situated on the external and posterior sides of the artery, and the other on its inner side. The tibial nerve is placed in front of, and on the outer edge of the arterial vessel, but it is not uncommon to find it situated on the inner side of the artery, which it pushes off towards the tendo Achillis. I have, whilst writing, an example of the kind in view.

The tibial artery furnishes a number of branches, all of which, however, are unimportant, with the exception of the one destined to anastomose with the external malleolar ; it passes obliquely from above downwards in front of the tendo Achillis. This branch may be wounded, if the instrument is depressed in too upright a manner at the surface of the tissues. In young persons the position of the parts is essentially different from what we find them in adults ; the abundance of adipose cellular tissue, the smallness of size of the tendo Achillis, and the slight degree of energy possessed by the muscles, cause the leg to present inferiorly a form almost exactly cylindrical ; the artery is proportionately larger than at a more advanced age, and the aponeurotic fibres which cover and protect it behind the malleolus externus, scarcely exist as yet at all ; the artery may also be felt, beating very superficially under the skin.

The veins large and gorged with blood surround nearly the whole circumference of the artery. The incomplete developement of the member causes an approximation of all its component parts; and from this source there arises a real difficulty and even danger, in as far as the division of the artery is dangerous, when the operation is performed imprudently, or when a departure is made from the rules which we shall presently lay down. These difficulties are still further augmented by the changes induced in the inferior portion of the leg, when the club-foot is completely formed. All these facts should be carefully noted—they are of the utmost importance to the operative surgeon.

The tendo Achillis, instead of running perpendicularly, as to the axis of the leg, deviates inwards, in order to reach the posterior extremity of the os calcis, and consequently it approximates more nearly to the artery than it otherwise would do. This, subservient to the rule so happily established by M. Guérin, becomes more and more flexuous in proportion as the distance which it has to run is more or less reduced; it follows the direction of curvature of the limb, and the artery and tendon are in almost immediate contact.

The venous system follows the same course, as to change of direction, as the arteries; it is also greatly preponderant—which circumstance, joined to the diminished size of the artery, is extremely fortunate for the protection of the latter from being wounded by cutting instruments.

These anatomical remarks lead us to conclude that, in order to avoid wounding the artery, we must necessarily attack the tendon at its inner edge, and keep as near to it as possible.

THERAPEUTIC INDICATIONS.

Treatment.

The deformity so often serious—caused by the developement of club-foot, the difficulty of walking, and the misfortunes which accompany it, promptly impress the relatives, and at a later period the patient himself, with the desire to remedy the defect. Most persons do not hesitate to make every sacrifice that such a dreadful infirmity may be removed. But, until the present day, how many anxious hopes have been disappointed! How much expense, courage, and patience have been expended for doubtful and unsatisfactory results! This was not because physicians misunderstood the indications to be fulfilled in the treatment—the object was evident—the indications are simple—they are reduced to merely *re-establishing the form and functions* of the diseased foot. The labours of many physicians have been directed towards this object

alone, and some happy results attest that they were well acquainted with the nature of the disease, whilst a great number of failures also proves that they had not been so fortunate as to discover the proper mode of treatment. Let the causes of the disease be what they may, the fundamental pathological derangements are reduced to the contraction of one or more of the muscles of the leg, and to a more or less extended deviation of the articular surfaces. This is the evil. Is it always curable? Up to what age is it capable of being remedied? And what are the circumstances that may render the cure impracticable? These are important questions, which we must examine prior to the establishment of the methodus medendi. The astonishing success recently obtained in the cases of individuals whose feet were horridly deformed, and who had been afflicted for a long time with large callosities, ulcers, wasting away, atrophy, and almost an entire paralysis of the lower extremities—a success which is daily multiplied, enables us to assert that, in almost every instance, club-foot is curable. Advanced age is, however, an obstacle; the operation will probably prove unsuccessful, if the bones have acquired their full size and hardness, or if ancylosis exist, or if the articular surfaces, worn away by rubbing and pressure, have lost that bony polish which permits them to slide over one another with such facility, and the thickness which would oppose itself to the return of the foot to its natural shape. We must never despair, however, as there are instances of cures having been accomplished in the cases of individuals of forty years of age and upwards. There would be an evident contra-indication to undertake the treatment, should the patient be paralysed in both his lower extremities in consequence of disease of the spinal marrow, and I have met with one example of this kind; or if there should exist a congenital luxation of any one of the bones of the tarsus, as was the case in the patient spoken of by Professor Ehrmann. These occurrences are so rare, however, that it may now be considered as an established fact, confirmed by experience, that club-foot of every variety is almost always capable of being promptly cured.

The main object of the physicians of antiquity, and of Hippocrates in particular, was to oppose to the effect produced by the contracted mucles, machines, which might, by counteracting the evil tendency, restore the foot to its primitive natural shape. At a more recent period, M. A. Severinus and Ambrose Paré, had recourse to tonic remedies for the purpose of strengthening the diseased members. Benjamin Bell was of opinion that the most effectual remedy that could be opposed to the shortened and contracted muscles, was topical emollient applications kept up for a long time. But what reliance can be placed in frictions and exciting manipulations? What beneficial effect can vapour, shower, or emollient baths have on shortened and constantly contracted muscles, or a deviation of articular surfaces?

Such impotent means have always failed, or if they have occa-

sionally appeared to succeed, the credit is due to nature alone, which has so frequently accomplished, contrary to every expectation, most remarkable cures. M. Stoltz knew a boy, the son of poor parents, who had a very decided inversion of the foot, which was totally neglected until the time when he began to walk. At this period they had made for him the simplest kind of boot, which after a time was replaced by a common shoe, made to fit his deformity; he was nevertheless spontaneously cured, about the age of ten or twelve years. Having been habituated from his earliest childhood to the carrying of heavy burdens, the exercise compelled him to apply the sole of his foot firmly to the ground, and throw its point as much outwards as possible. These exertions finally re-established the muscular equilibrium and length,—and at the age of twenty years it was impossible to discover that he had ever laboured under the disease.

Richter relates a no less remarkable case of spontaneous cure. A young man, who had been afflicted from birth with a very marked double club-foot, learned the tailor's trade at the age of fourteen years. From that time he was kept constantly seated with his legs crossed, as is requisite in exercising that profession, and he was soon astonished to find that his feet were beginning to assume their natural shape. The cure progressed insensibly, but was finally completed. This happy result must evidently be attributed to the fact of the extensor and adductor muscles having been kept in a constant state of relaxation.[1]

These fortunate cures, purely accidental, are much too rare to authorise a temporising system as a therapeutic means. I am not aware that any physician has ever proposed such a course; on the contrary, energetic action has generally been advocated, and some authors have even gone so far as to recommend the application of iron boots. Venel, Bruckner, and D'Ivernois, with a greater prospect of success, proposed the combination of tonic and emollient medicaments, with apparatus so constructed as to act at the same time on both the elongated and contracted muscles.

It was soon perceived that the emollient applications possessed the serious inconvenience of rendering the skin too supple, and of softening it so much as to give rise to excoriations, serious inconveniences which counteracted the beneficial effects of the mechanical means used, and frequently rendered it necessary that they should be suspended.

All physicians had been taught by experience that the application of mechanical force was their only resource against deformities of the feet, and, until recently, this means comprised the whole therapeutic treatment. All the machines invented, had for their object the creation of a power, which, by acting on the foot, made to perform the office of a lever, might oppose the resistance caused by muscular action. These apparatus were exceedingly diversified in

[1] Held. Dissert. cit.

form, but they may all be referred to the two systems of dead and elastic forces. The first includes a great number of machines and some bandages, and the second, every oscillating apparatus, of the merits of which very opposite opinions have been expressed by physician orthopedists. Many modifications were made in the construction of the apparatus, occasioned by the varieties of vicious conformation, the peculiar views of the inventor, or to suit certain exigences of individual position or fortune.

As all these means are destined to the same end, we shall only speak of those which, by the simplicity or the success that has been obtained by their use, are still deserving of the attention of practitioners. The *apparcils immovibles* of Larrey, Seutin, and Dieffenbach, recommend themselves to our notice in preference to all others on account of their simplicity. As the two first have been long known, and are accurately described in many works, we shall only name them. The following is the bandage used by the Berlin professor:—after having rectified the position of the member, M. Dieffenbach takes two pieces of adhesive plaster about one and a half times the length of the leg, and begins by applying one end obliquely below the calf of the leg; he then passes it around the malleolus externus, the back of the foot, and its sole, and returns it on the opposite side in such a manner, that the two ends are made to cross on the external side of the leg; the object of the application of these two pieces is to prevent the foot from falling downwards and inwards. He then places along the inner face of the leg a bandage folded in the form of a loop, which is made to correspond exactly with the external edge of the sole of the foot, whilst the two upper ends united extend just above the calf.

These pieces are fixed by means of the figure of 8 bandage, wound from without inwards in such a manner as to contribute still further to maintaining the sole of the foot in an outward position, but not so as to enclose the loop, which in the mean time remains free and loose. This being done, the operator takes a strong splint about an inch and a half broad, made long enough to extend to the upper third of the leg, and having, at the distance of an inch from its inferior extremity, a double excavation, to which is attached a small flattened head,—and bringing the loose loop to the outer side of the foot, he there confines with it the neck of the splint, which is afterwards applied to the outer side of the member in such a manner that its head shall extend beyond the surface of the sole. He now fixes the whole firmly, and concludes with enveloping all the limb in a bandage. By this apparatus the foot is not only restored to a proper position, but locomotion, in place of offering any impediment to its action, rather adds to its efficacy; for, whenever the foot is allowed to rest on the ground, the little head of the splint touches first. As its point of support, however, is not sufficiently broad, and is, moreover, situated without

the centre of gravity of the body, at every step that the patient takes, there results a movement of reversion outwards.

The apparatus is simple and well conceived, and it may be applicable to some cases where the deviation is but slight, and the deformity easily remedied by the action of the hand alone.

The plaster mould proposed by M. J. Guérin, the mode of applying which has already been shown, will succeed as well, under the same circumstances, as the bandage of Dieffenbach; it must be borne in mind, however, that these means, which are suited only to young subjects, are long in perfecting a cure, and that the patient, treated by them, is very apt to have a return of the disease in a short time after their removal. This is a matter of great importance, and it cannot be denied that the cures, obtained by such mechanical means alone, are uncertain, often incomplete, and always leave the patient liable to a recurrence of the deformity.

The ingenious apparatus invented by Scarpa, Boyer, Delpech, and M. Stœss, an orthopedist of Strasburg, have each been used successfully in some cases, whilst they have been very frequently found to fail in others, and it cannot be denied that many patients, having experienced from their use a very prompt but temporary amelioration of their condition, have had the misfortune to see their deformity reappear, after all their endeavours to combat it during months and even years of inconvenience, pain, and privations of every kind. All these apparatus then, are liable to objection, and the fact should not be concealed that there is occasionally danger in their use. No matter how well they may be constructed, there must always be some parts which rest on the member, which will occasion pressure, friction, pain, ulceration, and even gangrene of the skin. One of the objects of their application, is to extend the retracted organs,—and this must necessarily give rise to deep seated pains, inflammation, suppuration, and, consequently, muscular contraction. Doubtless the physician will take every precaution to prevent such evil consequences of extension and compression; he will accustom his patient gradually to the use of the apparatus, and allow him in the commencement intervals of repose. Notwithstanding every precaution, however, he will frequently witness the supervention of violent pains—a sure indication of the approach of the accidents so much to be apprehended. When they do supervene, no time should be lost in removing the apparatus altogether,—it ought to be done without a moment's hesitation,—and if, after two or three attempts, the pain is found always to recur, it should never be permanently reapplied. Experience has proved, that when constant pain is the result of extension, if such extension is not instantly arrested, instead of assisting, it will only throw new obstacles in the way of a cure.

These apparatus and bandages are much less relied on since the introduction of the practice of dividing the tendo Achillis in the treatment of the disease, and the time is not far distant when they will be almost entirely abandoned, with the exception of cases of

very slight deviation, where the least traction will suffice to reduce the foot, in which plaster, the apparatus of Larrey or of Dieffenbach may be applicable, and should always be employed; for every operation, no matter how unimportant it may seem to be, is attended with more or less danger. With the exception of such cases—I repeat—the section of the tendo Achillis will soon supersede the necessity for the application of all these costly, fatiguing, and uncertain means; and the machines will be found only in museums—illustrating the history of the art.

The dividing of the tendon is a simple operation—soon over, and generally very easy of performance, whilst at the same time it is unattended with danger. It has been the means of establishing more radical cures in the space of a few years, than had before been accomplished during ages. It is worthy, then, our most serious attention, and I will endeavour to describe it with the most minute care. First, as to the division of the tendo Achillis,—and before proceeding farther, it will be well to recur to some of the most important surgical facts. It will be recollected that the posterior tibial artery is placed at the inner edge of the tendon to which it is united, and by which it is sometimes even covered superiorly; it becomes detached about the middle of the tendon, and is entirely separated from it at the inferior portion, after which it runs along the centre of the groove formed between the tibia and os calcis. The artery is accompanied in all its course by large veins, and by the posterior tibial nerve. It has already been seen that these important organs do not retain their normal relations in cases of club-foot, more especially when the disease is far advanced,—the deviation of the foot causes them to approximate more closely to the tendon; the veins, which are pathologically distended—as well as the artery, form flexuosities, which cause them to occupy a larger space than in their normal state. The tendon itself merits a moment's attention; from being very broad at its superior part, it gradually decreases in size, until it forms a large and nearly round cord, whilst at the distance of twelve or fifteen lines from the heel, it again enlarges for the purpose of being inserted into the os calcis—to obtain which insertion, it has to pass through a broad mucous bursa.

We are warned by these facts that the instrument used for dividing the tendon, may wound the artery, the veins, or even the nerves; and such accidents are the more likely to happen, if the patient be young, and the disease far advanced. If the tendon is divided too high up, the danger will be increased; and if on the contrary, the section is made too low down, there will be danger of opening the bursa mucosa, which would allow the escape of the synovial liquor into the wound, the constant presence of which would hinder the cicatrisation and hardening of the plastic lymph interposed between the ends of the divided tendon. From these considerations we have been induced to lay down the following rules, which are precise, and must not be departed from in any

case, where the object is to perform with safety the section of the tendon.

1st. The point for dividing the tendon, in adults, is at the distance of fifteen lines above the os calcis. In infants it must be varied according to the child's age,—in the youngest subjects the point ought never to be less than five lines from the heel. In case these directions should be forgotten, it will be well to recollect that a line drawn transversely, so as to divide the malleolus externus, will give the exact height at which the section should be made.

2d. The tendon should invariably be divided from its inner edge, as, by so doing, the instrument will be interposed between it and the vessels and nerves.

3d. The incision should be small, and ought never to traverse the skin through and through; this precaution is necessary to prevent suppuration and exfoliation of the tendon.

What is the most suitable instrument for performing the operation? Each operator has had his own instruments, which have differed more or less from one another. Delpech made use of a bistoury, held flat, for dividing the skin, and passing behind the tendon;—and for cutting it, he used a small convex knife. M. Stromeyer employs a pointed bistoury—very narrow, and bent so as to present a convex edge.[1] M. Bouvier uses a lancet to make the opening in the skin, and then introduces a small straight knife scarcely larger than a cystitome.[2] M. Stœss also uses two instruments, a double edged bistoury—having the blade very narrow—and then a probe pointed bistoury bent to a very obtuse angle, and having only a small convex edge on the curved part.[3] In my own opinion, two instruments are not required for the performance of such a simple operation,—they serve only to increase the difficulties, and prolong the duration of the operation. Why should it be necessary to withdraw the cutting instrument at all, after it has traversed the tissues? If, by accident, any important part shall have been wounded, the necessity of having to introduce the second instrument, will prevent the surgeon from endeavouring instantly to remedy the evil.

For these reasons I have determined to make use of one instrument only in performing the operation. M. Duval also uses only one; I call the knife which I use, *Ténotome*:[4] it is a very simple instrument,[5] consisting of a blade nearly similar to that of a scalpel, inserted into a strong handle; the blade differs, however, from that of the scalpel, in its being more narrow, and having the point convex on both sides,—the curvature of the cut-

[1] Archives Méd. tome iv. page 103—104.
[2] Bulletin of the Academy, Dec. 1836, p. 200.
[3] Held, Dissert. p. 53.
[4] From τενων, tendon, and τομη, section.
[5] See plate vi.

ting edge commences near the point. I have adopted this form in order to avoid chafing the skin at its internal edge, as is apt to be the case, when the operation is performed with other knives; the back of the instrument is quite thick, and its curvature much greater than that of the point. I think it better that the back should be made thick, in order that it may be set firmly against the tendon, for in some individuals this offers very great resistance to the action of the instrument. The edge of the *ténotome* looks towards the broadest side of the handle; this disposition is made in order to afford a large surface for the fingers to rest on, and thus insure the instrument's being held firmly in the hands of the operator.

Position of the patient.—When the patient is a young child, I have him placed on his abdomen, and supported on the knees of an intelligent assistant. When an adult is to be operated on, I place him in the same position on a bed; one assistant holds firmly the lower part of the leg, whilst another seizes the foot and flexes it for the purpose of stretching the tendon, and making it prominent. If the patient is a child, I myself take charge of the foot, and move it in the manner indicated,—then holding the ténotome in my right hand, I apply its point against the tendon, whilst with the fingers of the left hand which are free, I stretch the skin by pulling it a little inwards. To execute the *first part* of the operation, I now thrust my instrument through the integuments, keeping it as near as possible to the tendon, and turn it from behind forwards, and from within outwards. When, by the depth the blade has penetrated, and sometimes by a slight external protrusion of the skin, I find that my instrument has passed beyond the tendon, I prepare to execute the *second part* of the operation. The handle of the tenotome being depressed, the edge of the blade is consequently firmly applied against the parts to be divided; I now move the instrument very slowly backwards and forwards,—a peculiar noise soon announces the separation of the tendinous fibres, and suddenly a quick, dull, crackling sound proclaims the entire division of the tendon. I immediately cease to press on the instrument, and withdraw it slowly from the wound, at the same time arranging carefully the integuments. A depression, varying in extent according to the degree of contraction of the muscular fibres, occupies the place where the tendon previously was. The operation, thus performed, is attended with but little pain, and I have frequently seen it borne by children without their uttering a single cry.

When the ténotome is withdrawn, a few drops of blood escape from the wound, scarcely ever, however, more than four and five. As soon as this is stopped I press the little wound lightly in order to expel that which may have accumulated under the integuments or in the tissues,—a precaution which I think useful, inasmuch as it prevents the formation of clots, the presence of which might give rise to irritation and suppuration. A small pledget spread with cerate being placed over the wound, a compress and bandage complete the dressing. I leave matters in this state for five or six days,

at the expiration of which time, the first dressing being removed, the wound is generally found to have healed, and now is the time for reducing the foot, which by-the-by will be frequently found to have already commenced, under the influence of the active contraction of the extensor muscles.

I commence this operation by enveloping the foot in one or more long compresses of several folds, and then apply a bandage of the breadth of two fingers around it, in the form of the figure of 8, which, descending from the external side of the leg, passes under the inner edge of the foot; such a disposition of the bandage is indispensable, as it tends to depress the inner edge of the foot, and elevate the external edge. Indeed it will sometimes be found sufficient of itself to maintain in a proper position club-feet that are not highly aggravated; the bandage being applied, I next arrange the apparatus for reduction.

This machine is very simple[1]; it is composed of a wooden sole larger than the foot, and perforated by several mortices; a strong leathern heel varying in height according to the age of the patient, but which should, nevertheless, in no case exceed an inch and a half, is fixed to the posterior part of the sole; and on the inside of this heel two leathern tongues, pierced with eyelet holes, are attached, which are intended to lace on the instep, in order to keep the heel in close contact with the sole;—two steel uprights with hinges at the height of the malleoli, and two arcs of circles placed transversely for the purpose of adding to the solidity of the uprights, embrace at their inferior extremity the sole, to which they are firmly secured by means of rivets. One of these uprights has attached to its outer side, and at the height of the malleolus, a ratchet with a double spring click (*double fourchette*) to stop it. This part of the apparatus is indispensable for keeping the foot at whatever degree of flexion may have been given to it. At first I had but one click (*fourchette*) behind, but I soon saw that it was frequently bent by blows or involuntary movements. These two clicks (*fourchettes*) are capable of being simultaneously separated by means of a fixed (*clef à demure*) but movable key, placed above, and at a short distance from the ratchet. All the metallic parts of the apparatus are lined with leather, and there are two leather straps to go around the upper part of the leg. When the foot is placed in this machine, and the two leather straps, destined to fix the heel, laced, I put an end of a bandage through one of the mortices of the sole, and pass it several times around the foot and the sole, for the purpose of keeping it flat, and endeavouring to bring it back to its normal position; the remainder of the bandage is made to describe the figure eight, by passing around the foot and the sole, but without including the metallic uprights. In the commencement the foot forms a right angle with the leg, but every six days I incline it on the leg by advancing the clicks (*fourchettes*) one tooth on the ratchet.

[1] See pl. vi—the figure represents an apparatus for a child of four years.

This simple and cheap apparatus might be replaced by that of Scarpa, by adding to the latter the ratchet and double spring click (*double fourchette*) for the purpose of opposing any quick or irregular movement of flexion. The bandages soon become deranged, and it is necessary that they should be reapplied, whenever they are found relaxed. At every reapplication a new effort should be made to reduce the foot to its natural shape. It generally requires six weeks for the complete consolidation of the new tendinous tissue, and for the foot to become divested of the habit of inclining in an improper direction. But it frequently requires no more than eight or ten days, and even a shorter time in some cases, for its complete reduction. When the consolidation of the tendon is completed, half boots should be made with very thick stiffnings, and two long leather straps on the inside, for the purpose of lacing over the instep, and keeping the heel firmly applied against the sole. The patient should endeavour gradually to re-establish the functions of the leg, but never fatigue himself.

Those authors, who have preceded me, have given but incomplete directions with regard to their operative process, and such as are wholly insufficient to guide the surgeon in an operation for the division of the tendo Achillis.

Delpech, to whom, I take pleasure in repeating, we are indebted for our first exact notions with regard to the operation under review, has laid down the following rules:

1st. The tendon to be divided ought never to be laid bare,—it should be cut in a slanting manner, and not by an incision parallel with the skin, for in that case it would probably exfoliate.

2d. Immediately after the tendon shall have been divided, the two ends should be approximated and maintained in contact by means of a suitable apparatus, until they are reunited.

3d. This reunion having taken place by means of the interposition of a new formation of fibrous matter, it is necessary before that substance has become completely solidified, to elongate it by means of extension gradually increased.

4th. When a sufficient lengthening has been obtained, the parts should be immediately fixed in their proper position, until the intermediate substance shall have acquired all the firmness of which it is susceptible.

Operative process of Delpech.—In the case recorded in the *clinique chirurgicale* of Montpellier, Delpech divided the tendo Achillis of a young man nineteen years of age, in the following manner. The patient having been placed on his abdomen, he thrust a bistoury, which was held flat, behind the tendon in such a manner as to occasion on each side of it an opening of about an inch in length; he then withdrew the instrument, and introduced into the wound a convex knife, the cutting edge of which was turned towards the tendon, which was then divided transversely without implicating the skin situated above. But by this operation it was impossible to prevent the exfoliation of the tendon; the sup-

puration was very abundant, and extension could not be used until the twenty-sixth day, and the sides of the tendon had become adhered to the cicatrices which formed but slowly on account of the suppuration. At first, the movements of extending and flexing the foot occasioned a puckering of the skin, but this inconvenience disappeared in the course of time.

Process of Stromeyer.—The Hanoverian surgeon, from the time of his first operation on the 28th of February, 1831, modified the process of Delpech in the following manner. The patient being seated on a table in front of the operator, with the left side towards him, one assistant held the knee down firmly, and another seized the foot, and bent it, so as to stretch the tendon forcibly,—a pointed bistoury, very narrow and bent so as to make the cutting edge convex, was thrust two inches above the insertion of the tendon, between it and the tibia; the back of the instrument being turned towards the bone, and the cutting edge towards the tendon; this latter was divided by the mere introduction of the instrument; the section was accompanied with noise. The indication of making the external wounds as small as possible, in order to avoid the entrance of the air, the exfoliation of the tendon, and suppuration, was, the author says[1] perfectly fulfilled, for the point of the bistoury only passed through the opposite side, without making a bleeding wound, and the entering wound was only of the size of the blade of the instrument. In his second operation, performed on the 12th of June, 1831, the author used the same process, with the exception, however, that the tendon was divided in this case at the distance of three inches above the heel.

Although this operation is nearly analogous to that of Delpech, it nevertheless differs from it; in that the author took great care to make the incisions as small as possible, which was an important step towards improvement, and his success is owing to this circumstance. We congratulate M. Stromeyer on it, but at the same time we do not hesitate to state that there are inconveniences attending the double wound, and danger in dividing the tendon as high up as three inches above its insertion into the calcaneum.

Process of M. Bouvier.—The patient being placed on his abdomen, a small opening was made with the point of a lancet parallel to the axis of the leg, only a few lines from the tendon, and opposite to that point where it was found to be smallest and most prominent. This opening permitted the introduction under the skin of a small, straight probe-pointed knife, scarcely larger than a cystitome This ténotome was passed between the skin and the tendon, which latter was then easily cut from without inwards, without wounding the integuments on the opposite side. The foot was then placed in an apparatus constructed so as to maintain it flexed on the leg, and thus keep the ends of the tendon separated.[2]

[1] Archives générales, vol. iv. p. 103.
[2] Bulletin of the Academy, Dec. 1836, p. 200.

This process is attended with the serious inconvenience of having to cut from without inwards; the instrument—if the tendon should give way suddenly—might be carried downwards on those deep-seated parts which it is of the utmost importance not to injure. Here we also have the inconvenience of two instruments.

Process of M. Stœss. The object of this operator, as of MM. Bouvier and Duval, is to perforate the skin on one side only, and divide the tendon from as small an external wound as possible. For this purpose he introduces between the tendon and tibia, a double-edged bistoury with a very narrow blade, (it is only a line and a half broad,) held flat, with which he makes an incision two lines and a half long, taking care at the same time not to perforate the skin of the opposite side; it is then withdrawn and replaced by a probe-pointed bistoury, bent in a very obtuse angle, and having a very small convex cutting edge on the bent part. The straight part of the blade is placed in front of the heel, where the instrument is made dull to prevent its enlarging the external wound, at the moment when the bistoury being turned vertically, performs by a saw-like motion, the section of the tendon. The division being made, the instrument is immediately withdrawn, and the wound closed by the finger, to prevent the entrance of the air into the vacant space left by the retraction of the two ends.[1]

This process is likewise liable to the objection already made, of employing two instruments, when one only can be as advantageously used. This description, as well as the preceding ones—leaves something also to be desired as to the point to be selected for performing the operation, according to the age of the patient; and some directions should be given as to the precautions necessary to be taken, to avoid wounding the artery and veins.

Process of M. Duval. This expert orthopedist has not yet published an account of his process, or at least I have not met with it, although I have in one case seen him operate; in this instance he used but one instrument, of which mine is only an imitation; he took great care not to traverse the integuments on both sides, and divided the tendon with remarkable dexterity.[2]

Consecutive Treatment.—It is not enough to have overcome the principal obstacle to the reduction of the foot, the parts must be replaced in their normal position, and in order to obtain this result, it will be found indispensable that the following indications should be fulfilled:—viz. to overcome the inordinate contraction of the

[1] Held, Diss. cit. p. 53.

[2] [An account of M. Duval's method of operating, will be found in the Bulletin of the *Royal Academy of Medicine* of Paris, of the 15th March, 1837, and in his "Traité pratique du Pied-bot," Paris, 1839, in 8vo., page 117. It does not differ essentially from that of our author, and the instrument which he uses, is the acknowledged original of that of M. Scoutetten. M. Duval is, however, in the habit of employing occasionally in the cases of very young children, and under certain circumstances, straight probe-pointed scissors, with which he has in three instances operated successfully. *Transl.*]

muscles, and to restore the articular surfaces to their natural relative positions. These indications can only be accomplished by time and a suitably constructed apparatus. It can easily be conceived that a certain time is requisite for restoring to their normal position bones which have become separated, and there would be serious inconveniences attending its being greatly abridged, for this could not be done without violent pressure and traction, occasioning pain, a stretching of the ligaments, and a convulsive contraction of the muscles, which, giving rise to inflammation, might retard, and would probably hinder altogether the re-establishment of the union of the two divided ends of the tendon. Here it is that the wise precept of Hippocrates should be remembered—"*neque magnâ vi, sed leniter cogantur!*"

The reduction is nevertheless performed in some cases with wonderful promptitude; I have seen many feet strongly distorted, perfectly restored in six and eight days, and it rarely requires more than fifteen.

The reduction was obtained in the thirty cases reported by M. Duval to the Academy of Medicine,[1] in from ten to twenty-five days. Agreeably to my own observation, accidental club-feet are the most easily reduced.

But at what time should the apparatus be applied? Authors do not agree on this subject; according to some, the application ought to be made immediately after the operation,—whilst others are of opinion that a period varying from five to fifteen days should be allowed to intervene. In the cases of the two persons first operated on by M. Stromeyer, the apparatus was not used until the tenth day. M. Stœss has frequently applied it on the fourth and fifth day, and I have seen M. Duval arrange it immediately after the operation was over. My practice is always to leave my patients at liberty for four or five days; the object is to avoid extension, which, if combined with the irritation caused by the division of the tendon, might induce inflammation. At the expiration of four days, then, and when the wound is healed, I apply the machine. How ought the foot to rest in the apparatus? Should it be inclined, so as to favour as much as possible the approximation of the ends of the divided tendon—as advised by Delpech and the greater number of operators who have succeeded him? And should the elongation of the intermediate substance secreted by the ends of the tendon be gradual? These are important questions which appear to me not to have been duly considered. It is generally admitted as necessary, that the two ends of the tendon should be as nearly approximated as possible, and then to cause a progressive lengthening. The newly secreted substance appears to be viewed in the light of glass rendered soft by the application of heat, which may be extended at pleasure. We instantly reply to such an assertion, that if the elongation takes place as is supposed, it can only be by diminishing the

[1] Bulletin of the Academy, Jan. 1837, p. 304.

thickness and cohesive power of the newly formed tissue, and that this tissue would thus be exposed to the possibility of being broken by violent or too long continued extension. It should still further be recollected that nature is not too bountiful or extravagant in the use of her "*vis medicatrix!*" and thus when she has caused the re-union of divided parts, the secretion of the fluids, destined to become solidified, ceases. Notice the phenomena which occur in the case of a fractured bone,—if the fragments are closely approximated, the plastic juices are secreted in small quantity, whereas if they are widely separated, the secretion is very abundant, and the callus extends to some distance around the parts.

These facts would lead us to infer that it is wrong to attempt bringing together the divided ends of the tendon, and that it would be better, within certain limits, to pursue an opposite course. At all events up to the present time, I congratulate myself on having conformed to such precepts. I place the foot, then, in the machine in such a manner that it shall stand at a right angle with the leg, and keeping it in this position for ten or twelve days, I then gradually and progressively bring it up to an acute angle of 55° or 60°, and never to 70°, as has been proposed, for there are many serious objections to keeping it so very much flexed. We must afterwards rely on the efforts of nature to make the parts supple, and restore to them their natural motions.

When I think it proper to flex the foot, I always do so slowly; I hold it firmly with my right hand, whilst with the left I raise the clicks (*fourchettes*) which rest on the ratchet, one of the teeth of which indicates the extent of inclination that I make. As long as the foot is kept in the apparatus, the position of the heel must be carefully watched,—the final success of the operation depends on the attention that is paid to its being placed and maintained in a proper position. The heel, which has a natural and decided tendency to become elevated, is still further assisted by the motions of the child, and the relaxing of certain parts of the apparatus. When any such displacement is perceived, every thing should be instantly removed, and the parts replaced in a suitable position. It is but seldom, especially in the commencement, that three days elapse without the displaced parts of the machine requiring re-application.

Although the little wound may be completely healed, I take the precaution constantly to surround the foot with several soft compresses, which are kept in their places by means of a bandage. I even take the precaution to apply a very thick piece of linen over the parts on which much pressure is likely to be exerted; it is in this manner that I protect the skin which covers the astragalus and calcaneum from pressure which might bring on inflammation and gangrenous eschars—misfortunes which many operators have had to regret.

Accidents.—Many accidents may immediately follow the section of the tendo Achillis, the most serious of which would be the division of the posterior tibial artery; very fortunately an example of

the kind has as yet scarcely occurred,—at least we may infer from the silence of operators that it has never happened. It is to be feared, however, that at some future day it may occur, for the surgical anatomy has already shown us that such a thing is possible, especially when the operation is performed on young children. Under such disagreeable circumstances the first object of the operator should be to compress the femoral artery, and at the same time endeavour to arrest the hemorrhage by applying a dossil of lint over the wound, and supporting it with a tight bandage. A stop being thus put to the flow of blood, the surgeon will have to choose between tying the femoral artery at the middle of the thigh, the popliteal artery, or the vessel itself immediately above the wound. The last seems to be the most simple, but it is nevertheless by no means the easiest,—from the difficulty that would be occasioned by the extravasation of blood in the cellular tissue, and the inconvenience that would be experienced in arresting the flow of blood. Whenever it is practicable, however, this part should be chosen, as it will be found most advantageous to the patient. If the child is young, and abundantly supplied with cellular tissue—a circumstance by the way very rare in the limbs of club-footed persons, it would be more prudent and easier to tie the femoral artery at the middle of the thigh. The facility with which the anastomotic communications are made renders this operation much less dangerous in young children than adults.

In performing the section of the tendon, the little artery might also be divided, which goes from the posterior tibial to the external malleolar, and passes in front of the tendon. Such an accident would not probably be serious,—the only danger would be a small sanguineous effusion, which, by the coagulation of the liquid, would soon stop the hemorrhage.

The veins have been frequently wounded,—it has happened in my own practice in two instances.[1] The accident may be detected by the abundant flow, in a continued stream, of blood more decidedly red in proportion to the youth of the subject. This coloration of the blood may surprise and alarm the operator; he must quickly, however, regain his self-possession, in order that the assistants may not perceive the danger which he apprehends, and instead of being in a hurry to stop the blood, he should allow it to run for a short time, for the double purpose of assuring himself by the jet, of the nature of the vessel wounded, and of obtaining the disgorgement of the veins, so that the hemorrhage may be the less likely to recur.

When the jet decreases, the vein should be compressed, and a small pledget covered with cerate applied, over which a thick compress ought to be placed, and the whole firmly secured by means of a bandage. In such cases, as under more favourable circumstances, I allow the dressing to remain four or five days without touching it.

[1] See cases 1 and 4.

If the nerve should be wounded, severe pain would result, which would at once evince the nature of the accident. I know of no example of the kind having ever occurred,—if it should happen, nothing could be done, but to apply topical emollients and narcotic ointments.

After the instrument has traversed the tissues, it may, instead of passing entirely around the tendon, penetrate through its fibres, and thus leave some of them untouched. Such an accident is indicated by the incomplete retraction of the tendon, and the resistance offered by its undivided fibres,—a resistance which the operator may easily detect by the touch. A case of the kind once occurred in my own practice, in the person of a young lady twenty-one years of age; it was easily remedied by re-introducing the point of the bistoury, and dividing the fibres which remained.

Inflammation, suppuration, and exfoliation of the tendon are of rare occurrence; they however supervened in the case of the patient operated on by Delpech, and the cure, although eventually completed, was retarded by them.

It may so happen, although there be a total absence of all inflammatory action, that the two ends of the tendon will never reunite. This is a serious accident, inasmuch as it precludes all hope of cure. M. Stromeyer had a case of this kind, in a boy seven years of age;[1] the foot retained its vicious conformation.

When the section of the tendon is cured, the foot may in some cases still present a decided deviation; this accident occurred in the case of a lady of thirty years of age, who was operated on by M. Duval, and it was occasioned by the contraction of the tibialis anticus muscle. The tendon of that muscle was divided, and the cure soon after completed. Gangrenous eschars may supervene, when the precautions, which I have indicated for preventing violent compression of the skin, are not used. In the case of the first patient operated on by M. Stœss, one eschar made its appearance on the heel, and another on the first metatarsal bone,—two month's treatment was required to cure them.[2] In a patient treated by M. Duval, the formation of an eschar prevented the application of the extending machine for more than six months.[3] If it should happen that the skin is traversed on both sides, or completely divided, the wound should be closed, and an endeavour made to obtain an immediate reunion.

[1] Nouvelles Observ. in Archives générales, vol. 5, p. 194—1834.
[2] Held, Dissert. cit. p. 69.
[3] Bulletin of the Academy, Jan. 1837, p. 307.

SEQUELÆ OF THE OPERATION—PROGRESS OF CURE—CHANGES IN THE LIMB OPERATED ON.

The section of the tendon is followed by an immediate and quick retraction, varying from a few lines to an inch and more. A hollow is felt under the skin, indicating the unoccupied space; if the blood has accumulated under the skin, which ought, if possible, to be prevented, and which is moreover very rare, a slight bluish coloration will appear. There generally forms during the first three or four days, a slight sub-cutaneous swelling, which is not, however, inflammatory; the cavity is then filled with a concretable fluid, out of which is formed the new tissue destined to replace the tendon. The small external wound heals between the second and fourth day.

About the tenth day the plastic lymph becomes thickened, and begins to harden; the tissues in the immediate vicinity of the wound are swollen, and present to the touch the sensation of an unequal surface. Between the fifteenth and twentieth day, the new tissue becomes isolated, begins to assume its form and to get round; sometimes a sort of thick ferrule may be distinctly felt at the point where it is in the act of uniting to the superior end of the tendon. At the expiration of a month, the consolidation has become completed, and no evidence remains, except perhaps the very small cicatrix, to show that any operation had been performed. In the cases of some individuals of a lymphatic temperament, the progress of cure may be less rapid, but two months will always prove sufficient for the indicated results to obtain.

Direct experiments have been made on animals, with the view of discovering the mechanism of the reproduction of the ligamentous cord which supplies the place of the divided tendon. M. Bouvier presented to the Academy of Medicine of Paris the tendons of the extensor muscles of the foot of a dog, which had been killed thirty days after they had been divided, and which were found to have been reunited by a solid substance. The two ends of the tendon were seen to be separated about the distance of an inch, and their continuity re-established by a new fibrous tissue, which had formed in the interval. This substance presented the same form and external appearance as the tendon itself, and, like it, adhered loosely to the cellular tissue which served as its sheath, so that as far as solidity and mobility were concerned, it fulfilled perfectly all the functions of a tendon. Nevertheless it has been found from this case, and many more similar experiments, that the new tendinous substance differs from the true tendon in being of a grayish colour, and in having a more condensed texture,—so that its formation bears about the same relation to the regeneration of tendinous tissue, as the production of cicatrices of the skin does to the integuments, the true structure of which is but imperfectly replaced by them.[1]

[1] Bulletin of the Academy, 15th Oct., 1836, p. 32.

Remarkable changes are soon manifested in the member operated on; the muscles of the calf become developed, the cellular tissue is distended with fat, the sub-cutaneous veins are made apparent, the callosities become effaced, and if the deformity has not been highly aggravated, the leg gradually assumes the form and size of an originally well-shaped limb. There are, however, some persons, who are never wholly divested of all the effects arising from the deformity.

DIVISION OF THE TENDONS OF THE LATERAL PERONEI MUSCLES FOR THE CURE OF EVERTED CLUB-FOOT.

When the contraction of the lateral peronei muscles occasions *everted* club-foot, it becomes necessary, as in the case of the tendo Achillis, that they should be divided. This operation has been but seldom performed, as *everted* club-feet are of more rare occurrence, and generally not so highly aggravated as the *inverted* variety.

The rules to be observed in performing this operation are exceedingly simple; it is only necessary to refer to what has been already said with regard to the situation of these muscles, to comprehend the necessity of dividing their tendons at the distance of two or three lines above the malleolus externus; at this point they rest on the fibula, and are covered by the skin only.

Is it requisite that both tendons should be divided, or one only? It appears to me to be very doubtful whether the tendon of the peroneus *longus* can be easily cut without that of the *brevis* also. It could only be done in cases where the peroneus longus makes a very decided protuberance under the skin, and I have seen a case of this kind in a young lady of Alsace, who would not consent to have the operation performed. But even admitting the possibility of dividing one of the tendons alone, I do not think that it would be attended with success, for in almost all cases they both contribute to the developement of the disease.

The operation is reduced to merely introducing the ténotome under the skin, using it carefully on account of its great tenuity, and dividing the tendons of the lateral peronei muscles. We cannot admit the practicability of cutting them below the malleolus, as great difficulty would be experienced in dividing the fibrous tissues and ligaments which exist in that region.

DIVISION OF THE TENDON OF THE TIBIALIS ANTICUS FOR THE CURE OF CALCANIAN CLUB-FOOT.

The decided protuberance made under the skin by the tendon of the tibialis anticus in cases of calcanian club-foot renders this operation remarkably easy. No accident need be apprehended, if it were not for the possibility of dividing a venous branch which ramifies on the instep—and that would be of too little importance to cause a moment's uneasiness to the operator.

Is it necessary in cases of a simultaneous contraction of the extensor tendons of the big toe, and four last ones, to divide them successively? I have no hesitation in answering this question affirmatively, as it does not appear to me that nature would be more embarrassed in establishing this multiform reunion, than in the case of but one large tendon. I think, however, that it would be better not to divide all at the same height, in order to avoid weakening the skin too much at one point. I intend pursuing this course in the case of the patient whose feet are represented in the fifth plate.

INDIVIDUAL CASES.

Case 1.—Congenital inverted club-foot highly aggravated. Extreme youth of the child. Division of the tendo Achillis. Venous hemorrhage. Complete cure.[1]

Joséphine H——, of Plombières, was only eleven months old when I saw her. She was born with a club-foot of the right side; the misfortune occasioned in the parents great anxiety, and they most ardently desired that the deformity should be cured. I advised them to have the tendo Achillis divided. They acceded to the proposition, and the operation was performed on the 25th June, 1837. There was great deformity, the sole of the foot being very strongly inverted—the tendo Achillis hard, and retracted—opposed the restitution of the foot to its natural position. So very decided was the deviation, that I could expect to derive no benefit from the application of machines, or plaster and bandages. I concluded then to perform the operation, but it was impossible for me not to foresee difficulties, and even danger, in practising on so young a person. The imperfect developement of the parts, the position of the artery, which was felt distinctly beating against the tendon, and the size of the veins which surrounded it—were all very unfavour

[1] See plate I. fig. 1.

able circumstances: thinking, however, that I might by prudence avoid the dangers, I operated. The tendon was easily divided, but on withdrawing the instrument a stream of blood followed, which was red, and coagulated rapidly; in my emotion, I thought for an instant that I had cut the artery. The jet, however, was not intermittent, and was arrested by pressure made below the little wound. Being now satisfied as to the nature of the accident, I continued the pressure with my finger, and after expelling the blood contained in the wound, I applied a small pledget spread with cerate, and placing a long thick compress in the tibio-calcanian fossa, secured it with a bandage. I caused the child to be most carefully watched, and the first day passed without the occurrence of any accident. On the fourth day I removed the dressing, and found the little wound healed. The next morning the reducing apparatus was applied. It was only with the greatest difficulty, and minutest care that we were enabled to maintain the heel in a suitable position—this inconvenience, however, diminished in proportion as the foot became reduced. Ten days were found necessary to bring it back to its normal shape; on the thirtieth the child was completely cured. The apparatus was allowed to remain on during a longer time, however, in order to permit the foot to grow in a proper direction; it is impossible, at present, to detect by examination, which of the feet is the one that had been deformed.

This case presents as yet the only known example of the section of the tendo Achillis having been performed at so tender an age. The difficulties encountered, and the risks run, lead me to ask if it would not be more advantageous, and certainly more safe, to postpone the operation to a period when the organs shall have become more isolated and distinct? I do not hesitate to reply in the affirmative; but are there not other inconveniences attendant on delay? The aggravation of the accident with age, the difficulty and sometimes impossibility of walking, the wasting away and deformity of the leg, and, finally, the distress of the parents, are motives which ought to induce us to attempt the cure at as early an age as possible. In order to meet all these indications, I think it best to wait until the child has acquired the age of two years at least. I have followed this rule in my own practice, and think that I may congratulate myself on having done so.

Case 2.—Little girl, aged two years and a half. Inverted club-foot, with retraction of the toes on the sole, reduced in fifteen days. Cure completed in six weeks.[1]

Ida Auvert, aged two years and a half, was born with a club-foot of the right side, and no attempt was made by the relatives to lessen the deformity. When the child was presented to me, the following was her condition: Locomotion impossible, the foot strongly contorted inwards, the malleolus externus almost in contact with the

[1] See plate I. fig. 2.

ground, scarcely any heel, the calcaneum, in consequence of being drawn upwards and backwards, formed an acute angle with the tibia, the sole of the foot was very concave, the toes were bent, and could only be very slightly extended by the strongest effort.

On the 25th June, 1838, I prepared for the operation; the child, placed on its abdomen, was held on the knees of one of my assistants. I assured myself of the situation of the artery; it ran along the inner edge of the tibia, and seemed to be in contact with it—an unfortunate, and yet almost constant condition in young children. In order to avoid wounding the arterial vessel, I caused an assistant to hold the point of the foot firmly, whilst with the left hand I pushed the tendon off towards the fibula, by placing my thumb on its inner, and the index finger on its outer edge; with this last finger I also stretched the skin near the point where my instrument was to penetrate. All these precautions being taken, my *ténotome*, although introduced slowly and cautiously, divided the fibres of the tendon so rapidly that I could scarcely distinguish the projection and the noise which always accompanies the division of the last fibres. The child did not utter a single cry, and only a few drops of blood escaped.

Notwithstanding the section of the tendon, the foot remained deformed, and I was unable to reduce it entirely to a normal direction. Fearing that I might not have divided with my instrument all the tendinous fibres, I introduced a stylet into the wound, and discovered that some remained in fact untouched; they were promptly divided, and, what is very remarkable, the gastrocnemius muscle scarcely contracted at all, the result of which was that the interval between the ends of the tendon was very short. The little wound being covered with a pledget spread with cerate, a compress and bandage completed the dressing. The bandage was wound from without inwards, in order that the folds surrounding the foot might assist in bringing it back to a natural direction.

The following morning I saw with pleasure that the deformity had diminished; the child did not suffer at all. On the fourth day the extending apparatus was applied, and on raising the dressing on the sixth, I found the wound completely healed—the heel was gradually descending, and the toes becoming elongated. On the tenth day the interval between the ends of the tendon was filled up with a soft, elastic substance. By the twentieth day the foot had assumed a natural shape, and the newly made tendon was gaining its form, and becoming detached from the surrounding cellular tissue. By the thirtieth day the operation was completed, and the foot which had been progressively flexed on the leg, was removed from the apparatus on the 3d of August, the thirty-ninth day after the operation. For the purpose of completing the cure, I caused a half boot to be made with very stout stiffenings, to press and maintain the foot in a suitable position.

Case 3.—A youth of ten years. Convulsions when in fourth year. Semi-paralysis of the left arm. Retraction of the gastrocnemius muscle of the same side. Inverted club-foot very decided. Reduced in eight days. Cure completed in one month.[1]

François Leturc was a strong and healthy child; when, at the age of six years, he was attacked with acute encephalitis, complicated with violent convulsions, and the child was thought to be in a desperate state. Contrary to every expectation, however, he survived, but his left arm remained partially paralysed, and there was a very evident wasting away of the muscles; the pelvic extremity of the same side was also weakened, and the gastrocnemius muscle became considerably retracted, which occasioned the developement of a most highly aggravated case of club-foot. The malleolus externus rested on the ground, and the principal weight of the body was borne by the back of the foot, whilst the sole was directed inwards and upwards, and the toes turned backwards. It was most distressing to see this child walk, and it could scarcely be conceived why so unnatural a distention of the ligaments did not give rise to such severe pain as altogether to prevent locomotion. The calf of the leg was very thin, when compared with that of the other side, and the heel was drawn up more than two inches from the ground.

On the 20th July, 1838, every preparation having been made, the child was laid on its abdomen, and supported on the knees of its mother; an assistant seized the end of the foot, and endeavoured to flex it on the leg—the tendon was thus made exceedingly tense, and the operation was over in a few seconds. The division of the last fibres was accompanied by a very decided noise. Scarcely as many as five or six drops of blood escaped, and the child did not utter a single cry. The tendon retracted with great force, and left a subcutaneous vacuity of at least fifteen lines in length. After carefully expelling the blood, which seemed to have a tendency to accumulate between the two extremities of the tendon, I brought the edges of the wound together, and applied a pledget covered with cerate, which was supported by a compress and bandage. Notwithstanding the wide separation of the ends of the tendon, the foot was but imperfectly reduced; I was desirous of applying the extending apparatus immediately, but the pain which it occasioned forced me to remove it. These circumstances caused me some apprehension as to the success of the operation, but what was my surprise on seeing, the next morning, that the foot had been almost entirely reduced by the unaided efforts of the extensor muscles? This being the case, the reducing apparatus was now applied without difficulty. The bandage which surrounded the foot having become displaced on the fourth day, I was enabled to see that the little wound was completely healed, and the cicatrix scarcely perceptible. The place which had been left hollow by the retraction

[1] See plate II.

of the tendon, was hard and slightly swollen, and the child experienced no pain. On the eighth day the foot was completely reduced, and no trace could be detected of the previously existing deformity, except a hard callosity just over the os cuboides. On the fifteenth day a very decided protuberance was felt about the superior extremity of the tendon, and the cure was completed on the twenty-fifth day after the operation.

The spontaneous reduction of the foot in this case, caused by the retraction of the extensor muscles, is a remarkable circumstance. It was to me a useful lesson, and since that time I have been very guarded in the application of the extending machine immediately after the operation. I learned the important fact, that nature, on being relieved of the obstacles which opposed the normal developement of the foot, would endeavour instantly to restore to the parts their proper position, and that she would attain this end gradually, and without any violent exertion: the deformed parts, also, not being compressed, would be less exposed to violent inflammation, which might occasion deplorable consequences.

This case serves still further to show the facility with which accidental club-feet may be restored; so decided a case of the congenital form, as that of young Leturc, would have required months of treatment, and it is even doubtful whether it could ever have been completely cured.

Case 4.—Double congenital club-foot. Child five years of age. Operation. Opening of a vein. Reduction of the feet in fifteen days. Cure completed in a month.[1]

Charles de L——, aged five years, was born with both feet highly deformed; the mother affirmed that she had experienced no extraordinary pain, or noticed any particular sign during the period that she was pregnant with this child, but that she had, on the contrary, suffered much more during two consecutive pregnancies, both of which terminated in the birth of daughters.

When Charles de L—— was brought to me, I was surprised to see the extreme deformity of the members—the feet overlapped, and their external edges rested on the ground, while the heels were forcibly everted—the tibiæ were bent, and one of the patellæ thrown on the inside, and the other on the outside of the articulation of the knee. The right foot was more deformed than the left; the malleolus internus did not protrude at all, and the astragalus seemed to have entirely abandoned the tibio-fibular cavity. Hard and painful callosities existed on both feet; locomotion was accomplished with great difficulty, and falls were of very frequent occurrence. I did not hesitate, notwithstanding these unfavourable circumstances, to operate on the child, and the section of the tendo Achillis was made on the 5th of August, 1838. The child was

[1] See plate III.

laid on the lap of an assistant, and the right foot was extended and held firmly by a second assistant, whilst I divided the tendon from the outer side. The operation was over in a few seconds, but on withdrawing my instrument, it was immediately followed by an abundant stream of red blood, eight or nine ounces of which escaped instantly. I was soon satisfied, from the character of the jet, that the accident would not prove serious, but I determined never again to perform the section of the tendon from the *outer side;* indeed this is now one of my principal rules in performing the operation.

The jet of blood was stopped by pressure made with the thumb above the wound. The skin having been cleansed, I applied my little pledget and compress, then a second long compress doubled into folds, and placed in the calcaneo-fibular fossa; a bandage secured the whole.

No peculiarity was presented by the other foot, and scarcely as many as five or six drops of blood escaped.

This double operation was attended with no accident; during the first day there was some slight agitation—this, however, was soon calmed by a long and refreshing sleep.

On the fifth day after the operation, I applied the reducing machine. The greatest difficulty was experienced in reducing even slightly the anormal direction of the feet; the bones, more especially those of the right foot, had deviated so much, and the tibio-fibular articulation was so narrow, that doubts might justly have been entertained of complete success.

Nevertheless, after eight days of anxious vigilance, and efforts made to oppose the elevation of the heel, the conformation of the feet was found to have undergone considerable amelioration. The reduction was complete on the fifteenth day, except on the right side, where the astragalus still protruded slightly. The cure was terminated at the fifth week. The child did not experience the slightest inconvenience during the whole course of treatment.

Case 5.—Accidental phalangian club-foot. A little girl nine years of age. Division of the tendo Achillis. Reduced in six days. Cured in one month.[1]

Ann Marie J—— was born, perfectly well formed, on the 2d of July, 1828; when one year old she upset a kettle full of hot milk, which occasioned a burn involving the lower extremities in nearly their whole extent. A violent fever, and other serious consequences, endangered for a time the life of the child. An evident amelioration, however, was manifested; when she commenced cutting four large teeth, a renewal of the fever was occasioned, and convulsions supervened. The child endured these accumulated evils, and after many vicissitudes during convalescence, got well. The relatives

[1] See plate IV.

were not long in perceiving that the right leg was shorter than the other; the heel was drawn up, and the foot rested on the ground only by the toes—locomotion was very difficult, and was accomplished only by decided limping. At this time I saw the child; its health was good, and I had no hesitation in proposing the operation. It was performed on the 5th of March, 1837; no accident happened, and the foot was reduced with incredible rapidity—by the sixth day after the operation it had resumed its regular form. The machine was allowed to remain applied for a month, after which time the cure was fully accomplished. Time has not weakened this prompt and remarkable success.

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Inverted Club-Foot.

Fig. 1st

Reduced in ten days.

Fig. 2nd

Reduced in fifteen days.

Inverted Club-foot.

Reduced in fifteen days.

On Stone by A. Vinsac.

P.S. Duval Lith. Phila.

Double inverted Club-feet.

Reduced in fifteen days.

Phalangian Club-foot,

Reduced in six days.

P.S.Duval, Lith. Phila.

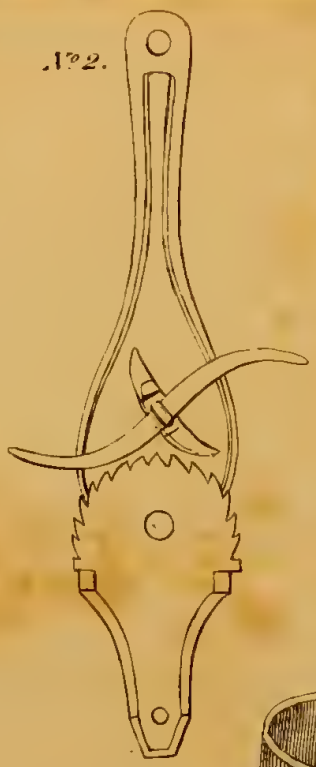
Calcanian Club-Feet.

Models of Ratchets.

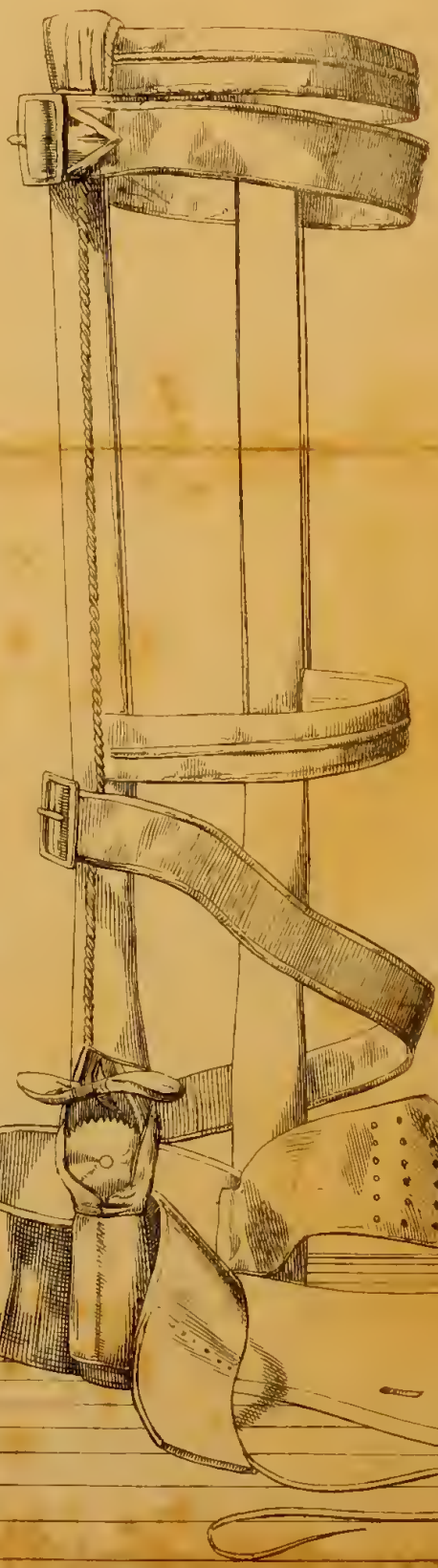
Reducing Apparatus.

Nº 1.

Nº 2.



Tenotome.



Ric Hu Lith. Phil.a

REPORT

OF

PRIMARY SYPHILITIC CASES.

BY CHARLES ASTON KEY.[1]

I select, for the present paper, Cases of Primary Venereal Sores, in men admitted into the Samaritan Ward, under my care, since the year 1825. They are classed under the following heads, according to the character of the sore and other circumstances connected with the case. To avoid, as far as possible, confusion, by the introduction of new names and new divisions,—a proceeding that more often tends to obscure than to elucidate the matter,—I adhere pretty closely to the received nomenclature of venereal sores: and as the term chancre is understood by all, to be a sore produced by venereal infection, I use it as applicable to all such sores, whatever character they may bear; distinguishing one class from another according as they exhibit more or less evidence of poisonous action, and also according to the character which the existing state of the constitution may impart to them. The limits of the paper render it necessary to make the report concise.

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5.	Ditto, with phimosis and open bubo	4
6.	Raised chancre of the outer prepuce	44
7.	Ditto, with bubo,	13
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9.	Indurated chancre	23
10.	Ditto, with bubo	9
11.	Ditto, with phimosis	4
12.	Phimosis with chancres at extremity of prepuce	46
13.	Ditto, with bubo	8

[1] Guy's Hospital Reports, Oct. 1839, p. 411.

14.	Irritable chancre of inner prepuce and glans	41
15.	Ditto, with bubo	9
16.	Phagedænic sore of the outer prepuce	11
17.	Ditto, of glans and inner prepuce	23
18.	Ditto, with bubo	7
19.	Ditto, with phimosis	7
20.	Sloughing chancre	9
21.	Sloughing chancre, with bubo	3
22.	Ditto, with phimosis	17
23.	Phagedænic bubo	8
24.	Paraphimosis	13
25.	Ditto, with sloughing of prepuce and glans	2
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27.	Warts on glans and inner prepuce	16
	Warts, with phimosis	11
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	Warts with paraphimosis	1
	Warty ulceration of anus	4
	Condylomatous sores about the anus and scrotum	12
28.	Phimosis from gonorrhœa	24
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I reserve Cases of Bubo, and secondary symptoms, that are not here included, for a future report.

The name employed to designate chancres that are remarkable for their negative rather than their positive qualities, serves well enough to express this kind of sore. It is rare to find a sore wholly devoid of the thickened base, as the word "aphthous" might lead us to suppose; but the bursting of the vesicle or pustule sometimes leaves a sore presenting to the eye appearances so like those of an aphthous sore in the mouth, as well may excuse the appellation being retained. The nature of a chancre, I apprehend, will depend on the depth to which the action of the poison penetrates. In this form, its action seems to be confined to the surface of the cutis; blistering, as it were, the epithelium, without indurating the surrounding tissue; and such a sore will often quickly heal; leaving the practitioner in doubt as to its real nature, because it wants what, in his view, is a claim to the name of chancre. When it is more tardy in healing, and its stages of ulceration, granulation, and cicatrisation are more distinct and protracted in their course, the poison usually affects the parts to a greater depth, and what was at first a simple vesicle leaves a sore with a thickened base, as if the cutis and cellular tissue had become more imbued with the poison.

It appears to me, as far as my observation has gone, that the aphthous sore will thus often run into the more fully developed chancre; and that it is impossible to predict that a sore, at first aphthous in appearance, shall heal quickly, and shall not put on the more decided character of venereal action; or it will sometimes heal, leaving behind a very slight induration, and again break out

into a virulent sore, exhibiting the indurated form of venereal ulceration.

It may, however, be truly said, that this sore presents the least sign of a poisonous action, whether we look to the thickening of the base of the sore and its edge, or to the nature of the secretion and the appearance of the sore. And we are, therefore, warranted in the inference, that either it is the result of a peculiar poison mild in its nature, or caused by a virus common to all venereal sores, but exhibiting its action in its mildest form. This question leads at once to the much-debated one of a diversity of poisons; which, in spite of all that has been urged in defence of and against the doctrine, must remain in abeyance, until experiments, conducted on a large scale, by persons qualified for the purpose, shall have brought together an irresistible mass of evidence. Though the truth, in matters of science, cannot but be important and useful, the mere question, whether a variety of effects arise from one or from many causes, appears to me not to possess that importance which has been attached to it. And in saying this, I would not be thought to undervalue Mr. Carmichael's laborious services: for to him the profession owes much, as the first who successfully discriminated between the different forms of the disease, and grouped them with the hand of a master. If we admit that each group exists as this surgeon has depicted them, how does it advance us, to know that each has its peculiar poison? A virus is only known by its effects; and if it is established by sufficient testimony, that certain symptoms for the most part concur in individual cases, even though the exceptions may be numerous, all is proved that is required for the guidance of the practitioner.

When repeated experiments have proved that gonorrhœa, and every variety of primary sore, can be produced by inoculation with the same poison, I shall give in my adhesion to the doctrine of one venereal poison.

In the present state of our knowledge, the only well-grounded mode of proceeding is, to describe and distinguish sores according to their characters; as has been ably done by later writers—Carmichael, Bacon, Evans, Wallace, and others; of whom, a practitioner will take one or the other for his guide, as he finds their description confirmed by his own experience. My feeling, in regard to this matter, is, that the line attempted to be drawn between the different kinds of sores is too defined, inasmuch as nature points out no such lines of demarcation. Each sore is found, occasionally, to run imperceptibly into another class; so that it is difficult to decide to which it belongs. The aphthous sore, in its extreme form, has scarcely hardness of base or edge; but sometimes it has a slightly elevated edge, and consequently a deeper centre, as in the sore fringing the prepuce; and occasionally a rugged surface, with a somewhat hardened base, as at the corona glandis: an elevated surface, and firm base, as is often seen in a chronic sore on the prepuce.

It will be observed, that a large number in the catalogue of primary sores is classed under this head. The list includes not only the aphthous sores, in the strictest limitation of the term, but all those variations which I consider properly to come under this class —varieties depending on causes that I will briefly point out.

The hardness surrounding a venereal sore, on which so much stress is laid by most writers, as characteristic of and almost proportionate to the degree of virulence of the poison, has been looked upon, by many, as indicative of the presence of the venereal poison; and, when absent, to decide the non-syphilitic nature of a sore. Surgeons of the present day do not, perhaps, carry their views of induration so far as this; but it is usually supposed, that the greater the degree of induration the more decided is the syphilitic character; and Mr. Hunter is appealed to as authority for such opinion. But, in his work on the lues, he does not lay down any such exclusive rule: he says, "a chancre has *commonly* a thickened base; and although the common inflammation spreads much further, yet the specific inflammation is confined to this base." In speaking of a chancre on the body of the penis, he omits the characteristic hardness altogether, describing it as "a pimple that is allowed to scab, owing to its being exposed to evaporation: this scab is rubbed off, or pushed off, and one larger than the first forms." Again: "A chancre on the glans," he says, "appears as a pimple full of matter, without much hardness." We cannot, then, cite Mr. Hunter's authority in favour of the once prevailing but now declining opinion, that a true chancre is uniformly attended with a cartilaginous hardness. With his usual acumen, he had observed, and has not failed to describe, the variety in the characters of syphilitic sores. The above quotation describes one cause of this variety to be the situation of the sore.

The site of an aphthous chancre (but stating this may be considered as begging the question of identity) greatly modifies its condition and progress. It penetrates at one time only through the surface of the epithelium; and forms, on the glans or inner prepuce, a superficial sore, that often heals with one or two applications of the nitrate of silver, as a common vesicle would; the extent of poisoned tissue being so superficial as to be within the reach of this mild caustic. At the corona glandis, on the other hand, there is glandular structure and cellular tissue; and then we find this kind of chancre almost always firm at its base, deep in its action, and ragged, instead of being smooth on its surface. Over this sore the nitrate of silver has less influence, because it does not penetrate deep enough to reach the extent of the poisoned structure; and in such a case, when applied, it acts on a different principle. A chancre may be at first of the simplest kind, so as scarcely to be recognised as one: if touched with caustic, it may heal. If it breaks out again, it will sometimes evince more decided characters; and show a raised edge, and have a more firm base: or, if it begins as an aphthous sore, and is prevented healing, by friction, or want of

careful dressing, it begins to acquire, as the scab is successively pushed off, different characters; and, in a week or two, presents, in all respects, the most marked effects of the action of the poison. If nitrate of silver be applied to the sore in excess, the inflammation that follows will sometimes increase the thickness of its base, and seem to increase, as it is considered, the syphilitic character. The hardness of base and edge is usually greater in proportion to the duration of the ulcer, and by no means indicates a greater intensity of poison; for the most indurated sores that I have seen, of five and six months' standing from neglect, have been accompanied with a cartilaginous hardness; and yet in no other respect (as the kind of secretion, appearance of the sore, disposition to spread, intractability, or the character of the secondary symptoms) has it exceeded the mildest aphthous chancre. Sores at the end of the preputial fold, fringing the prepuce, and occasioning partial or complete phimosis, are usually remarkable for their hard base and elevated edge, and yet not possessing the other characters of a poisoned ulcer, yield to the simplest mercurial treatment: these are exposed to friction, are not easily protected by dressings, and occupy a part where cellular tissue abounds. It does then appear to me, that induration, though usually attending a chancre when seated in some tissues, cannot, when absent or present, negative or decide the action of the virus.

The circumstances that more especially stamp the syphilitic character are, the character of the secretion, and the aspect of the sore in its different stages—points of diagnosis that appeal only to the eye for recognition, and therefore not easily communicated by description. The stages of a chancre have been so well and so minutely described by various writers, as to make it difficult to follow the description, and almost hopeless, as well as useless, to attempt any addition. The vesicular, ulcerative, granulating, and cicatrising stages have been rendered so clear, and so familiar, that I should only repeat what is known, were I to say any thing on these points. In arranging and dividing the seats and forms of disease at the beginning of this paper, I have adhered to the generally received opinions on this subject. The best writers, beginning with Mr. Carmichael, who led the way in drawing a distinction between syphilitic sores, have endeavoured to establish a line of demarcation between each class, by taking a specific appearance as characteristic of each. When I first began to study syphilis, I had Mr. Carmichael's excellent work as my text-book. His classification of primary sores threw so much light on the causes of their various appearances—which pseudo-syphilitic doctrines had, to my poor judgment, involved in much obscurity—that I divided the subject according to his views. A difficulty, however, soon arose—into which class certain sores ought to fall; partaking, as they often did, of characters of two classes, and yet wanting some of each. The simple primary sore would come so near to the description of the raised ulcer, that I could scarcely tell to which class it belonged. More extended observation at length taught me, that the line of distinction was arbitrary; and that to

adhere strictly to the division of this excellent and ingenious surgeon, however one may estimate the correctness of his description, would be to draw lines that had not been drawn by the hand of nature.

When opportunities of observing these sores on a more extended scale had offered themselves, I found that the sores which might be termed syphilitic, inasmuch as they caused secondary symptoms, passed imperceptibly from one class into another. These aphthous sores I found continually to lose a part of their negative character, and to approach, in hardness of bone and edge, and appearance of surface, to the raised chancre of the prepuce, and also frequently to acquire some of the character of the indurated chancre; so that I experienced much difficulty in deciding to which order of sores they belonged. The indurated chancre of Hunter, as it is termed, would sometimes be defective in the ulcerating stage; having on its surface little more than an excoriation, covering the indurated mass, or sometimes even having an unbroken surface.

Finding that chancres possessed every variety and shade of character, I came to the conclusion, either that it must be occasioned by the difference of situation which it occupied on the penis, or by a varied action or intensity of the poison, or by a peculiarity of constitution. The former position, as offering a satisfactory explanation, is wholly untenable; for though situation must be allowed greatly to modify, in some respects, the appearance of sores; yet, as every variety of sore occasionally appears in the same part, it is obvious that some other cause must be in operation. To follow Mr. Carmichael's ingenious doctrine, of a separate poison producing each variety of sore, would be to introduce an almost endless variety of poisons: and if the line of demarcation between classes of sores be not so clear and defined as Mr. Carmichael describes them, and one class runs insensibly into its neighbour, it follows that the poisons producing them must possess but slight shades of distinction, and must, like the sores which they produce, closely resemble each other in the middle of the chain, while at the extreme points their difference must be considerable. At first, it appears inconsistent with the definite progress of disease arising from one poison, that in one person a chancre should be an excavated sore, and in another an induration of tissue with scarcely a breach of surface. We see, however, in other diseases, a similar variety of action from the same cause. In cancer of the lower lip, the disorder begins often with an excoriated surface encrusted with a scab, rising at length into a fungus with everted edges; then degenerating into an ulcer with a deep centre and raised margin, and at last presenting a foul phagedænic sore: this is an instance of the same action being (so far as a cause is in operation) productive of dissimilar effects, and bears a close analogy to the diversity of sores produced by the syphilitic poison. The explanation of the variety in the instance of cancer lies in the accidental state of the powers of the constitution, and their ability to resist the disorganising tendency

of disease: if great, *cæteris paribus*, a fungous action ensues; if small, ulceration is the result.

This view of the matter differs but little from that of Mr. Carmichael. This slight difference, however, seems essential to a true understanding of the matter. I am far from wishing to derogate from Mr. Carmichael's claims to originality or usefulness, in the views that he has so well advocated. Entertaining, as I do, the opinion, founded on a pretty long course of observation, that venereal sores run one into the other, and are not separated by lines so defined as have been marked out for their distinction, it is impossible to admit more than a modification of poison. A modification may be considered equivalent to a difference of poison; perhaps it is.

The signs of the action of syphilitic poison I take to be those that are most fully developed in sores which, by common consent, are regarded as chancres, whose characters are not doubtful; and the consequence of which, if left to themselves, is, according to my experience, the occurrence of secondary symptoms. The induration on which such stress is laid, is a usual, not a constant or essential concomitant; though some degree of thickening usually attends a chancre. On this, therefore, when other signs can be obtained, I should be inclined to place less reliance than many are disposed to do: its absence certainly should not be regarded as evidence of that of all venereal taint, when other characters attest the presence of a poison. The early formation of a chancre varies in appearance, and cannot alone form a test: usually, it is vesicular, with slight excavation: sometimes there is no excavation at all in the cutis, which appears entire and level when the cuticle is removed. Sometimes induration commences with the formation of the vesicle, or even precedes it: and occasionally induration exists without vesicle or ulceration. The more mild, however, the action of the poison, both in its primary and secondary form, the more simple is the vesicle in its early stage, possessing a scarcely perceptible induration. The more intense the action of the poison, the more does the secretion differ from ordinary pus. It is of a reddish brown colour; gluey or tenacious in consistence, and semi-translucent. As the ulcerative stage ceases, this secretion gradually becomes denser and more opaque; but still retains its dark appearance, even when solidified in the first stage of granulation. When ulceration has ceased, the poisonous action still continuing, the sore is seen covered with a light brown layer of adhesive matter, not unaptly (as it has been) compared to chamois leather. In the milder forms of sores, the secretion approaches more to the appearance of common pus, more yellowish in colour, and less tenacious; and the firm deposite that succeeds the ulcerative stage resembles more the coagulable lymph of a common ulcer. These distinctions are gradually losing themselves as the sores more resemble the aphthous ulcer; so that the secretion of some differs so little from an ordinary opaque vesicle or pustule as to lead to the opinion that they are free from poisonous qualities. The nature of the secretion

can be best observed when the sore scabs over on the outer skin of the penis, or when the nitrate of silver, failing to arrest the secretion, forms a crust over a depot. All shades of character are to be seen in keeping with the other signs of virulent action, more or less determined according to its intensity. Mr. Evans has been led to believe that the activity of the disease depends on the stage or period at which the poison is communicated: if this be so—a position that would require a series of well conducted experiments to verify—it is only necessary to extend the principle, to explain all the various degrees in which the disease is found to exist.

The change which the sore undergoes, in its transition from the stage of ulceration to that of granulation, also presents characters sufficiently peculiar, to distinguish it easily from an ordinary ulcer. Usually, the only appearance to be observed in a common sore is, that the surface which had been the seat of active ulceration is gradually covered with granulations that become more and more defined, and assume, as they form, a healthy character. The process by which they are formed is hardly to be observed: but in a syphilitic sore, a distinct adhesive stage is to be seen preceding that of granulation, which, in a common sore, can only be observed under an accidental attack of inflammation. If a chancre proceed ever so favourably towards cicatrisation, unless mercury be employed to destroy its venereal character, the sore is usually seen covered with a yellow or brown layer of fibrine or buff, varying in colour according to the greater or less intensity of the action, and disappearing as the sore is more disposed to granulate. The granulations also possess a peculiarity in the minuteness as well as distinctness of their points, the great regularity of surface, and elevation of the granulating mass above the level of the surrounding skin: this latter feature is owing, possibly, to the induration of the base of the sore not having subsided before granulations are formed. The granulating stage is sometimes remarkable for its irregular action; the edge and several parts of the surface becoming prominent, and dark-coloured or venous in appearance, presenting a livid and rugged aspect. This is more usually the case in sores that have been disposed to slough, but in which the specific action has not been destroyed by the sloughing process, but becomes developed as the granulating action sets in. In the cicatrisation of the sore, there is little or no difference perceptible from that process, as it takes place in common sores.

Chancres evincing the greatest intensity of poisonous action are more frequently seen on the outer prepuce than on other parts of the organ; while the milder kinds are found on the thin covering of the glans, inner prepuce, and corona; the latter being covered with a finer cutis, and therefore more susceptible of the action of a milder poison; while the dense common integument of the body of the penis, resisting the action of the milder forms of virus, are acted on only by the more active causes of infection. Hence, on the body of the penis every stage of a chancre can be then more fully developed,

and its characters, in its different stages, more satisfactorily observed. Another reason for this may be, that sores on the integuments are less noticed by patients; or not regarded as chancres, but as excoriations; and therefore have the early part of their career undisturbed by dressings, and unchanged by mercury. The mild forms of sores that are seen fringing the extremity of the prepuce, and causing phimosis, are exceptions to the usual sores found on the skin of the penis: they are mild in their nature, often not followed by absorption or secondary symptoms; and when these do appear, they are of an unimportant kind. These sores are produced by the mild secretion lodging upon the end of the prepuce for a considerable time, and making up, by continued application, what it wants in intensity.

The early stages of chancre are rarely seen in hospital practice. Patients are not admitted, or do not apply, till some anormal change has taken place in the sore, or some difficulty has arisen in healing it. The class of sores seen in the wards are, therefore, different from those seen by the private practitioner, who alone can study the early phases of chancre, and learn what treatment is best adapted to them.

In the majority of cases of common vesicular chancre, the nitrate of silver is the best application. In the opinion of its advantages, as detailed by Dr. Wallace and others, I fully concur. When used properly, and under circumstances which ought not, in the eye of an ordinarily judicious practitioner, to forbid its employment, it altogether destroys the seat of the syphilitic virus, and thus prevents infection, both local and constitutional. Such an effect can only be looked for when the vesicle is seen in its commencement. If the action is not wholly arrested, an eschar is formed, which serves to protect the surface and limit its extension. Most commonly the ulceration extends; but is still benefited by this application, more than by milder astringents. When used as an astringent, in healing the sore, it should be applied more lightly than when employed for its escharotic action: for this purpose, the surface should be brushed with the caustic, and reapplied as often as the eschar peels off. Even in the granulating stage of a chancre, I often employ it, where common dressings are inconvenient, or likely to be improperly or carelessly made. The solid sulphate of copper is a good substitute for the nitrate of silver, when the latter excites too much action. Mercurial applications seem, in the early stages, to be peculiarly noxious, as if the action was rather increased than stayed by them; the secretion being rendered more copious, and ulceration more inclined to spread. Mercurial washes or ointments, in the ulcerated stage, I employ, not as a general rule, but as the exception in sores indolent, not sensitive, and secreting but sparingly. In the larger number of sores, mercurial applications are hardly admissible in our list of remedies: the common astringent salts—as the preparations of silver, lead, zinc, and copper—varied as the state of the sore will bear, check the disposition to spread quickly, and bring on an

appearance of granulation. To the premature use of mercurial dressings, much of the troublesome career of their sores may be attributed: their injurious action is seen in the conversion of the surface into a yellowish mass, a change that usually indicates ulceration, an increase of secretion, a disposition to spread, and an increased degree of sensibility: and as soon as these applications are replaced by astringents, the changes in the appearances of the sore show on what its previous condition depended. The same remark will not have escaped the notice of the experienced surgeon, in the influence of mercury, internally administered, on these sores: and while they remain in the ulcerative stage, it should be sparingly given and cautiously watched. Its beneficial effect, in lessening the thickened base of a chancre, cannot be doubted; but while it does this, it often acts injuriously on the surface, and gives to the sore a character approaching the phagedænic. Much of this evil may be obviated, by combining the internal action of mercury with local astringents, and increasing the quantity of mercury according as the sore seems disposed to granulate. When the granulating action is once established, the mercurial may then be increased with safety and with efficacy, and carried on until cicatrisation is complete. The diminution of mercurial action, as the stage of granulation proceeds, under the impression that the virus is destroyed, leaves an induration, after the sore is healed, difficult to remove, and forming a nidus of future mischief. As the inclination in the sore to spread ceases, and the surface becomes more disposed to granulate, I usually increase the quantity of mercury; as the sore now bears it better, and a greater security is gained against a reappearance of the disease. I cannot do better than quote the words of Mr. Hunter: "It should be given during the whole time of the cure (that is, as soon as its curative action can be brought to bear), and continued for some time after the chancre is healed. The quantity given should be such as may, in common, affect the mouth slightly." I do not, in this advice, see any recommendation of the proposed salivation to which Mr. Hunter is said to be inclined; nor do I see much in which it differs from the modern method of those who see much venereal practice.

In sores whose syphilitic character is not equivocal, even during the ulcerative stage, mercurial applications are found not to disagree. If the sore be bounded by a thick and firm margin which is raised and prominent, presenting, at its outer edge, a raised granulating boundary, while the inner edge is slowly ulcerating, and thus enlarging and perhaps deepening the sore, mercurial washes—either the chloride with lime-water, or the bichloride dissolved in water—act well, in retarding the ulcerating process. In the aphthous chancre, the disposition to spread is often remarkable: it is a sore of irritable temperament, and requires much caution, and more common, than specific treatment. But in the more decided chancre, the disposition to be "set astray" is less; and the syphilitic characters being more developed, mercurial application

agrees better with them, and may be applied with less apprehension of the ulceration extending. In these sores, local mercurial action does not render the secretion copious; nor does it render the surface yellow, loose, and spongy, or the edge disposed to break up, as it does in the aphthous sore: on the contrary, the edge becomes less raised and firm, but not disposed to extend by ulceration; the secretion is altered, but not increased; the surface becomes more solid and fibrinous, and inclined to granulate. If they present not the most decided characters, but verge towards the aphthous ulcer, a combination of the two plans may be had recourse to: an astringent may be used, for the purpose of protecting the sore from the injurious effects of mercurial action, while the sore is still receiving the benefit of that action: thus, it may be dressed with the black wash, and washed with a pretty strong solution of some of the salts alluded to. The tone and vigour of the tissue are preserved by the astringent, while the mercurial corrects the morbid action induced by the virus.

In the treatment of primary sores, I commence with mercurial medicines as soon as the preceding indications show the sore needs them, and carry them to the extent that the patient's constitution is able to bear. The principles by which the practitioner should be guided, in deciding on this difficult point, are those of general pathology. The remedial agency of mercury, in arresting the action of the syphilitic virus, is known to all, and acknowledged by all who study the course of this disease and the action of this medicine; but the numerous conditions that interfere with its action as a remedy, and tend to convert it into a poison, are less known, because they are more difficult to appreciate. I know of no rules that can be laid down for the guidance of the practitioner, except such as are so general, that they can hardly serve as rules: they are rather principles than rules; and where the straight line of action afforded by a rule fails—as in this, and indeed every other disease, it occasionally does—principle comes to our aid, as a never-failing guide. In the employment of mercury, its power of exciting the irritability of all the actions of the body is to be borne in view, and jealously watched. Its action on the heart and nervous systems, and, through them, on the functions of all the organs of the body both nutrient and reparative (for no organ is withheld from its influence), is to be carefully noted; lest, while it quickens all the organic actions, their energy and strength are not exhausted in proportion to the increase of their irritability. Every individual is affected by this remedy, in a manner peculiar to himself; nor is it easy to foresee how it will act on any individual constitution. In primary syphilis, an index fortunately exists, by which the injurious action of mercury is at once perceived: this is, the sore; a more delicate test cannot be desired: often, before any feeling of the patient, or any of his functions, show a sign of disturbance, the sore evinces a wayward disposition, that calls for a discontinuance of the remedy; and though opium, combined with it, may lessen the irritability of

the system, and dispose the sore to bear it, the idiosyncrasy of constitution is often such as to preclude the possibility of employing it, even in the smallest doses, without the risk of establishing an ulcerative action, attended with extreme irritability.

The sores that are attended with induration, as a distinguishing feature, are of three kinds. They form the opposite end of the chain to the aphthous ulcer; the various grades of chancre last alluded to constituting the intermediate links of junction. They are remarkable for their indolent character, and for possessing a hardness, from which the aphthous sore in some forms is quite free. Of these, that which is most commonly met with in practice is the sore familiarly known as the Hunterian chancre; which appears as an ulcer with an excavated centre, a mass of indurated tissue surrounding the sore on all sides, and an edge raised and slightly everted. These are, or rather are said to be, the tests of what Mr. Hunter considers a true chancre. Those who think so, I refer to Mr. Hunter's writings, with the recommendation, not to form an opinion from one or two expressions, but, from a fair and careful comparison of his remarks, to gather his full meaning. It is not my object here to rescue Mr. Hunter from the errors imputed to him,—that has been recently done by his commentators; but I would not seem to state an opinion opposed to that of so great a pathologist. I feel satisfied that Mr. Hunter would not have measured venereal sores by the degree or extent of induration. So acute an observer must have known, that many sores possessed of the greatest hardness are often greatly deficient in all the other signs of syphilitic action, in the nature of the secretion, in the aspect of the granulations, and in the entire absence of contamination of the inguinal glands, and constitution. The last instance that I have seen of this form of sore, occurred in a man about thirty-five years old, florid in complexion, and temperate in his habits. It appeared at the corona, as a common aphthous sore; which gradually spread, and ate its way deep, but slowly, between the glans and corpus cavernosum. When I saw it, its size was that of a large sixpence; and it felt like cartilage under the finger. Neither its secretion nor surface were those of a venereal sore; nor has any form of secondary infection made its appearance, although it has existed between four and five months. It healed quickly under a small dose of blue pill at night, and with a rapid diminution of the hardness. When combined with the other evidences of poison, induration is of some value in determining the nature of a sore; but alone, it is indecisive of the poisonous character of an ulcer, especially when seated in the cellular membrane, deep beneath the cutis. Sores are occasionally met with, where the induration amounts to a cartilaginous hardness, that possess scarcely a trace of a virus, having acquired the hardness by time and place. The deep chronic chancre of the corona glandis, mild in its character, and usually harmless in its effects, will last for months, and acquire a degree of induration that gladdens the heart of a *soi-disant* disciple of Hunter,

grieved to find the good old chancre fast disappearing from the land. This form of indurated sore is hardly to be classed with the two following; as its negative characters, with the exception of induration, coincide with the mild aphthous sore.

Among the chancres that claim the appellation of "indurated" are such as commence with a thickening of the cutis, or subjacent cellular tissue. Of these I have notes of two kinds, occurring oftener in private than in hospital cases. One begins with a redness and tenderness of the inner prepuce or corona; and the patient, feeling something wrong, looks for an excoriation, but discovers only a slight tumefaction, without breach of surface. If the red part, which is usually somewhat more diffused than in an ordinary character, be pinched up, the whole tissue feels harder than common, and very circumscribed. If neglected, as it commonly is, from the supposition of its harmless nature, these appearances increase, until the skin becomes glossy, and at length excoriated. The appearance of the excoriated part is highly florid and prominent, and a minute quantity of secretion can be seen oozing from it: there is not any appearance of ulceration. The vesicular and ulcerative stages are also wanting; the virus at once irritates the substance of the cutis into action; it swells, and becomes firm under the irritation, and throws off its cuticle without the intervening process of vesication. Such a sore is always followed, so far as my experience has gone, by absorption, and a train of secondary symptoms.

In the treatment, two circumstances force themselves on the attention of the surgeon,—the inability of the sore to bear mercurial applications, and the necessity of giving mercury in a cautious manner. Common mercurial dressings, lotions, or ointments, produce a painful degree of erythema, that soon renders it necessary to drop them, and to employ some mild lead astringent with opium, to soothe the irritability of the part: warm-water dressing is as good as any other; a few leeches on the body of the penis, if the pain be great, and the constitution show signs of disturbance. Mercury should be used at once; but given at first to tranquillise, and therefore with some form of opium, as calomel and Dover's powder; and I prescribe the same in the day-time, as disposing the patient to bear better the action of mercury. Desirable as it is to get the patient as soon as possible under the influence of mercury, too much care cannot be taken to watch its action: for though the sore may require it, the patient's constitution will sometimes become irritable under it; and the secondary symptoms of the disease are certain to exhibit the evil effects of this remedy, should its action have been carried on injudiciously, in the treatment of the primary sore. The form of medicine, therefore, should be such as will be least likely to increase the constitutional irritability of the patient, and effective enough to induce a curative action. From whatever cause it may be, the character of the secondary symptoms following this sore is usually severe, even when the constitution has not been influenced

by mercury; and therefore much circumspection is required, not to exceed the bounds of prudence in its administration. When prudently given, its beneficial influences will be evident; as its action will leave behind most mischievous effects, if it be indiscreetly employed.

The other kind of induration resembles, in many respects, the former. The virus neither excoriates nor ulcerates the skin; but the first intimation the patient has of infection, is a remarkable induration of the under-layer of the cutis, extending into the surrounding cellular membrane, forming a lump beneath the skin, from which it seems to grow. It gives but little uneasiness, even when pressed; and scarcely raises in his mind a suspicion of venereal infection. The points of difference from the former sore are, the entire freedom from inflammation and consequent excoriation or ulceration; the action being of the most chronic kind. The cause of this difference seems to reside more in the natural constitution of the patient, and his accidental condition at the time of infection, than on any essential difference in the virus. The obedience of the action to mercury, and the similarity of secondary symptoms, though they are usually of a less severe kind, stamp the sores as of the same kind, only differing in intensity. There is here no impediment in the prompt administration of mercury till the gums are affected, and keeping up the action till the mass softens and subsides. The constitution is usually in a state to bear it; and unless it is given to the full extent to produce its specific effect, secondary effects will arise in the skin and throat. The length of time that usually is allowed to elapse between the period of infection and the commencement of remedies gives the opportunity of absorption; which, in all the instances that I have seen of this form of the disease, has invariably occurred in a marked degree. The freedom from irritation of the part also invites the application of a mercurial; and the mercurial ointment is the best that can be used.

In the management of venereal affections, it is a point of the first importance to distinguish between the essential characters of the unmixed effects of the poison, and those features which they acquire from accidental circumstances. In the treatment of chancres, this distinction cannot too forcibly engage the attention of the practitioner; as upon it will depend, in great measure, the correctness of the opinion formed, as to the propriety of employing mercury, or withholding it. There are few chancres, when the disease takes, if it may be so expressed, its own course, undisturbed by external accidents or peculiarity of constitution, that will not bear this remedy with advantage: and, on the other hand, it may, I think, be safely and truly assumed as an axiom in practice, that when the character of a sore denotes the interference of an unusual action, by which it acquires a character foreign to the usual appearances of a sore under the influence of the virus, other remedies must be sought for, and employed in the place of mercury.

The next principle that ought to engage the attention of the

surgeon, is the kind of action that has, to borrow a phrase of Mr. Carmichael, "set the sore astray." A knowledge of the true appearances of a venereal ulcer gives him a correct idea of the extent to which the virus may be acting, in any given sore: but it is necessary to do more than this, and to determine on what depends the deviation of a chancre from its ordinary character, as well as what means will best check its anormal course. These three considerations always bear their due share in the opinion that I form of a venereal primary sore: first, the extent to which the virus is in operation: secondly, how far irregular or anormal actions are wound up with the action of the poison, and the proportion that each bears in determining the nature of the sore; and, thirdly, what peculiarity of action it is that creates the anormal character. Those causes, as giving rise to the class of sores forming the latter part of the list at the commencement of this paper, will be next considered.

The first head includes those which are usually called irritable, and which I have termed the mild, phagedænic sore. Irritability is the main cause of sores becoming phagedænic, and is a state assumed by chancres that ultimately become phagedænic. A chancre may become irritable from a local cause, or from a morbid peculiarity of constitution natural to the patient, or induced by habits of life, and mercury.

The former of these causes is often seen in operation in chancres seated on the penis, or the extremity of the glans, near the opening of the urethra. Such sores almost always are tardy in healing, from some untoward impediment. A frænal chancre at first resembles sores in other parts, and is treated in the same way. It seems obedient to the remedies, and promises well. At length, it ceases to be benefited by the means employed: the sore becomes, as it is called, indolent, and stronger measures are employed: the sore becomes painful, and the surrounding skin and frænum inflamed; and neither mercury within, nor stimulants without, are found to answer. If the ulcer does not spread, it becomes stationary, and is covered with minute red points of granulation, amid a yellow surface. Such is the common course of a chancre so situated, proceeding in this way, sometimes, for weeks; and unless principle be called to our aid, to explain the reason of its intractable state, applications are changed to but little purpose. The cause lies in an irritable kind of inflammation induced by local stimulants that disagree with the sore, and influence it and the surrounding tissue: neglect of the observance of a proper system of diet and regular hours increase the inflammation, and produce an irritability of the nervous and circulating systems which is increased often by the use of mercury. If mercury be withdrawn, or given in the smallest doses, with full doses of Dover's powder, to obtain rest—and, in the place of irritating applications, warm water, or lime-water and opium, be substituted—the tranquillity of the sore is soon obtained, the pulse of the patient soon shows the improvement of constitution,

and the process of reparation begins. The nitrate of silver is often useful in this irritable sore by keeping its surface unirritated and protected. The only remedy, in addition to purgation, that I employ, is the cold infusion of sarsaparilla in lime-water: its powder in allaying irritability of action, local and general, is incontestable: it lessens the frequency of the heart's action, softens the quick beat of the pulse, and diminishes the irritability of brain, evinced in the eyes; and of the intestinal canal, as indicated by the tongue, of most patients. When the languor of debility is present, this form of sarza is of little use; it is only when there is inordinate action, short of inflammation, that its benefits are distinctly seen; and not only in this, but in all forms of venereal sores accompanied by such conditions of irritability.

When seated on the extremity of the glans, and surrounding the urethra, the sore becomes irritable, and indisposed to heal under the continual irritation of urine, or if mercury be employed, it assumes at once a phagedænic disposition, and spreads rapidly. When irritable, it usually extends as far as the influence of the urine reaches, generally to about the size of a half-sovereign. It spreads slowly, making every now and then an abortive attempt to granulate; which ends in covering the surface, not with fibrine, but with a soft yellowish coating. The ulcer generally presents this projecting yellow sloughing surface,—arising, as I conceive, from the deposit not having tenacity or firmness enough to form the material for future granulations; but gradually softening down, and passing into the state of ulceration. In all sores of this description, maintained in their anormal state by local causes, longer time must be allowed for their passing through their different stages. If the same active mercurial treatment be adopted, in the hope of speedily correcting the action, the surgeon is disappointed; and the mercurial action induced is converted into one of irritation, as respects the ulcer. The only course he has to pursue, is, to act on the defensive, and to watch the appearances of the sore. If the sore is mild in its anormal deviation, and mercury, in small doses, seems admissible, it should be combined with sarza, or quinine, or opium, with the view of lessening its irritating effects. Mercury, however, in any form, is rarely admissible: it is better to begin, as soon as this disposition is observed in the sore, with the application of a solution of nitrate of silver,—from three to six grains, to the ounce, as can best be borne; and to continue it as long as the coating of the ulcer is indisposed to become firm in texture. As soon as the whitish slough becomes firmer in consistence, it shows that the disposition to ulceration on the surface is on the decline; and in this state it will bear a weak solution of mercury, occasionally applied, at first as a lotion, and afterwards as a continued dressing. A grain of the bichloride, dissolved in an ounce and a half of water, with the addition of three or four minims of the hydrochloric acid, forms a good lotion; and alternated with the astringent already mentioned, or with one of the metallic sulphates, will be found to correct the

sore as soon as any application that can be used. Smearing the sore with oil, at each time of micturition, protects it from the contact of urine, and is not to be neglected.

Mr. Hunter has much laid to his charge, of which he is wholly innocent. The excessive and indiscriminate use of mercury in all sores thought to be syphilitic, as recommended and practised by surgeons educated in the school of Hunter, had no authority in the precepts of that great master of our art. Observations of the same tendency as the following are dispersed throughout his work, and show how familiar he was with the tendency of sores to assume an irregular character, depending on some peculiarity of constitution at the time of infection. "The immediate or local effects of the venereal disease," he observes, "are seldom wholly specific; but they partake of the constitutional and specific inflammation; and therefore it is very necessary to pay some attention to the manner in which chancres first appear, and also to their progress; for they often explain the nature of the constitution at the time." And further on, he describes more explicitly the various irregular actions into which chancres are thrown, by peculiarities of constitution. "If the inflammation spreads fast, it shows a constitution more disposed to inflammation than natural: if the pain is great, it shows a great disposition to irritation: it also sometimes happens, that they very early begin to form sloughs: when this is the case, they have a strong tendency to mortification." In these discriminating observations, that point out, in the clearest though concise manner, the various causes that modify the course of venereal sores, are to be seen the doctrine of modern pathology, stated in the simplest form. Mr. Hunter's object, in all his writings, was the elucidation of principle: a less profitable minuteness of detail he left to others. The distinctions that he makes between the action of the virus, and the accidental features imparted by circumstances not confined to primary ulcers, are to be met with in different parts of his work where he speaks of the secondary forms of infection: and the spirit of them so deeply tinctures the whole of his syphilitic views, as to make it matter of surprise, that his immediate successors, by overlooking them, should have brought his doctrines into disrepute.

The more immediate effect of a phagedænic tendency in sores is an extension of the ulcerated surface; and the cause lies in a morbid degree of susceptibility or irritability of the system. Ulceration is the destruction of tissue by inflammation: it is clearly not a process of absorption, but one of simple disintegration of tissue: it occurs only when the vital powers are reduced, and are unable to control the action that tends to disorganise the structure. It differs from gangrene in this, that while, in gangrene, vitality ceases before the disintegration of the tissue has time to take place, in ulceration the parts are still subject to the vital powers while they are undergoing a change from a solid organised texture to a fluid inorganic mass. What the state of circulation is in parts undergoing ulceration, is difficult to ascertain: it cannot wholly cease at once, as gangrene

would be the result. It is probable that the influence of the nervous and circulating systems are gradually withdrawn from the surface of parts about to ulcerate. Whatever may be the physical explanation, the physiological state is one of weakness, accompanied with an excess of action in both the vascular and nervous system of the part.

The circumstances that bring on this irritability of frame ought to be an object of attention, in the treatment of phagedænic ulcers; for it is to this condition especially that the practitioner has to direct his remedies. In large towns, thronged with a vicious population, these sores are among the most common forms of primary syphilis. Irregular hours, impure air, hard labour, overstrained powers, and intemperance, contribute, each their share, towards disturbing the course of a venereal sore. It first becomes inflamed, and exceedingly painful: the inflamed tissue breaks down, and ulcerates away: the former healthy limits of the sore, in their turn, undergo the same process. The constitutional state of the patient is evinced in his irritability of manner and loss of rest, in his pallid aspect and slightly vascular conjunctiva, while the heart acts quickly but feebly.

In the adaptation of treatment to these sores, the degree of power which the patient possesses, and the degree of inflammation in the sore, as they materially influence its character, should be special objects of the surgeon's attention. The general principles of allaying irritability, and giving tone, is the course which the surgeon traces for himself; but something more than this is required, to enable him to arrest these spreading and sometimes intractable sores. The distinctions between an irritable and an inflamed ulcer are sufficiently broad; and yet the terms are often confounded, and even misapplied. An inflamed ulcer, because it is painful, is regarded often as an irritable sore;—an error that leads to most painful mistakes in practice, inasmuch as the treatment most apposite to the reduction of inflammation is neglected, and the sore is brought under the action of remedies that tend rather to increase than allay inflammation. The vivid colour of the surface, the fibrinous deposit covering the granulations, the ichorous discharge, and the thickened edge, one or all evince the existing degree of inflammation; while the absence of those signs, and, in their place, a degree of sensitiveness disproportioned to the extent of inflammation, or a disposition to spread by ulceration, is evidence of an irritable state of sore. But though the extreme of each class of sore is distinct enough, the line that divides them is not so clear or defined. Many sores exhibit more or less of both characters. An ulcer may be highly sensitive, and at the same time inflamed; and yet not be disposed to spread in consequence of the patient's vis vitæ not being sufficiently reduced: while a similar ulcer, in another patient, attended with the same degree of inflammation, shall become phagedænic from want of constitutional vigour. Inflammation, therefore, as a cause of phagedæna, is not to be lost sight of;

nor an exclusive regard be paid to the irritable state of the sore or of the patient. A mixed view of a case leads to a mixed mode of treatment. The degree of inflammation present, and the degree of irritability existing, combined in various proportions, are the conditions that modify the progress of ulcers: and the discernment of the practitioner should be directed to ascertain in what proportions they do exist. Inflammation in one degree, combined with much irritability, tends to destructive ulceration: a higher degree of inflammation, with a less degree of irritability, leads to the yellow slough: while the highest degree of inflammatory action, with a further diminished irritability, produces the dark slough, or common gangrene.

In the constitutional treatment of these sores, if some such principles as the foregoing be borne in view, it is not difficult to arrest them. Mercurial action is wholly inadmissible: it tends to increase irritability, to lower the powers of the patient, and therefore to quicken the phagedænic action. Loss of rest, and the irritability of the arterial and nervous systems to which it gives rise, are the prominent points in these cases. Opium, and its various preparations, must be given, to obtain rest: moderate doses only are required; except in some few cases, that hard drinking and debauchery have rendered uncontrollable by smaller doses of opium. In such persons, three or four grains are required, to procure sleep. When this desirable object is obtained, the sore often quickly improves in appearance. If the aspect is marked by much vascular action as well as nervous excitement, the cold alkaline infusion of sarza is the remedy that deserves our confidence. When, in place of a vascular conjunctiva, and flushed face and white tongue, the aspect bears marks of depression and debility, ammonia or quinine, or similar stimulants, are called for. The remedy, however, on which most reliance is to be placed, is iodine, and its combinations.

Before this powerful remedy was known, the medicines on which most reliance could be placed, for the purpose of arresting anormal syphilitic action, when induced by mercury or any other similar cause, were sarsaparilla and mineral acids, especially the nitric. To these may be added some other tonics in general use. Much as these were esteemed, they were not generally allowed to possess any specific action over the disease, beyond their properties of giving tone to the system, and tranquillising irritability. That they have great power in arresting unhealthy ulceration of venereal sores cannot be questioned; and in persons with constitutions impaired by irregularity and disease, in whom mercury is inadmissible, these medicines have a strong claim on our confidence: and when they failed, perhaps more was to be attributed to the inefficient dose, than to a want of efficacy. The salts of iodine have, in great measure, superseded them; as experience has proved them to exert a control over anormal syphilitic action that no remedy, hitherto known, possesses. Its property seems to be stimulant or tonic: it increases vital energy and action, rendering the pulse strong and full: it improves the

appetite and powers of digestion, imparting vigour to the chylopoietic viscera: hence its benefit seems especially adapted to that kind of ulceration which depends on want of power, combined with an excess of irritability. In both the mild forms of phagedæna, and in those sores that are covered with the yellow slough, it is found most serviceable; it imparts vigour to the weak textures, and enables them to resist the disorganising process of ulceration. The inflammation that attends these sores seems also to be within its control; for in a day or two after its exhibition, the sore that had been painful becomes easy, and the blush of inflammation assumes a fainter colour, and its area diminishes. This action of the remedy is seen in chronic inflammation of glands in strumous persons, and is improperly attributed to its absorbent property: absorption is the consequence of the arrest of inflammation; and when iodine can be brought to bear with effect on chronic inflammation, absorption of the effused fluids follows. How much of the control that iodine exerts on anormal sores is to be attributed to a specific power over the poison, is difficult to say; but we are limiting its powers too narrowly, I think, if we confine its action to the common inflammation that surrounds the sore. Both in the primary and secondary forms of this disease, it is often found to arrest the progress of syphilitic action, in persons who cannot bear mercury; and, next to that mineral, iodine seems to possess the highest anti-syphilitic powers. Its effects are less permanent, and less certain, in the normal forms of disease; but its action is less injurious to the constitution. Mercury increases the irritability of the system in many persons, enfeebles the constitution, and disposes sores to phagedænic action: the effect of iodine is the reverse of this: it may be said that iodine fulfils that in which mercury is deficient. In the normal forms of syphilis, this mineral is rarely found to disappoint the expectation of the practitioner; and in the anormal forms of primary sores, it as rarely fails to do harm: while iodine exerts, comparatively, little influence over the normal chancre, chiefly confining its good services to the sores that are "set astray" by some peculiar condition of constitution. The forms in which I employ it, are, the iodide of potassium alone or combined, and the solution of iodine in this salt. I do not find it necessary to increase the dose beyond seven grains of the salt, or half a grain of the pure iodine. In some of those sores that are not amenable to the action of iodine, the aid of mercury, in small doses, is wanted, and in such forms as produce the least disturbance of the system. It is best given at night, with Dover's powder, in form of the chloride, or the gray oxide with chalk. The action of mercury is sometimes wanted for sores that, having shown an anormal disposition, have lost it under the action of iodine, and yet will not granulate or cicatrise. The syphilitic action still predominates in them; and yields only to mercury, which should be given in the most guarded manner.

The more intense forms of phagedæna are those in which a sloughing action alternates, or coexists with ulceration. The action

is similar to that which attends the milder phagedænic sores: but the causes that operate are more active, and the destructive ulceration is proportionally more severe and rapid; it may be properly enough called sloughing phagedæna. The principles that should regulate the treatment of these sores are the same as guide us in the milder phagedæna. The powers of life, in such patients, rarely permit the use of the lancet; nor, indeed, does the nature of the sores require it, as the inflammation is of the asthenic kind, and requires rather an opposite plan of treatment. Rest is usually sufficient to subdue the inflammation that may be present: and when inflammation of a more active kind attends the early stage of phagedæna, a few leeches will suffice for its reduction. To tranquillise the excessive irritability that always accompanies them, is the main object. Opium, or morphia, in full doses, should be given at night, to procure rest; and if that fails, it should be given at intervals of four or six hours, combined with such stimulants as the previous habits of patients may render proper. Camphor, capsicum, and quinine, form a useful addition to opium; with the allowance of wine or spirits, that custom has rendered necessary. Stimulants are usually required in the treatment of these sores; but harm is sometimes done by having recourse to them indiscriminately, in all cases. When irritability of the nervous system is joined with great vascular excitement, evinced by a sharp and rather full pulse, a vascular conjunctiva, and a flushed cheek, opium should be given only in small doses at night, and other measures employed that tend to allay irritation, without increasing vascular action. The cold alkaline infusions of sarza form, in such cases, a good substitute for the stimulants and tonics above mentioned: and as soon as the pulse is quiet, iodine, in some form, is found to put a stop to the ulcerative action. These measures often check the more severe, as they do the milder forms of phagedænic sore; and the propriety of using them, in preference to stimulants, must depend on the condition of the patient; the latter should only be used when the powers of life are enfeebled, and irritability maintained by want of the accustomed stimulus. The local applications that have most efficacy are those of a stimulating kind. The undiluted nitric acid is one of the most effective, as well as most safe; and one application to the whole surface of the ulcer, so as to imbue the whole ulcerating and sloughing textures, is usually sufficient to arrest the mischief: it converts the ulcerative action into a sloughing one; and the white or yellow parts become brown, die, are cast off, and leave a healthy granulating surface. Solutions of nitro-muriatic acid with opium, the cataplasma cumini, Peruvian balsam, with equal quantity of liq. opii sedativi, are useful when the sloughing prevails more than the ulcerative action. I cannot confirm the propriety of giving mercury for the white sloughing sores, as advised by a late writer on syphilis. The recommendation seems fraught with danger: it is inadmissible so long as the ulcerative action is going rapidly on; and should be given, if at all, only when the white

coating of the sore has acquired a firmness that indicates the cessation of phagedænic action. Happily, mercury is altogether needless; as iodine is sufficient of itself to check the ulceration, and to produce a healthy granulating surface. Even when every sign of phagedænic action has left the sore, it seems better to defer the use of mercury, for the healing of the sore, or with the view of preventing secondary symptoms. Mr. Carmichael's advice on this head is valuable; and his observations on the action of mercury, in these sores, will be found correct.

The dark brown slough, approaching almost to a black, is the result of an action different from the former, in the process of ulceration being wanting, and the texture at once passing into a state of sphacelus, from the rapid change effected in it by inflammation. This kind of sore may be either the effect of a neglected aphthous chancre on the inner prepuce, or may commence as a black sloughing spot on the glans itself. The worst instance that I have witnessed of it began as an aphthous sore on the corona, that healed in three days; and broke out again, after some excess in wine; and immediately assumed a sloughing action of a most destructive kind. The high degree of inflammation induced by the poison seems to be the cause of this dark sloughing sore; which is therefore usually more painful than the white sloughing one, and attended with greater constitutional disturbance. It is almost always attended with phimosis; which is not unfrequently the cause of the inflammation that renders the aphthous chancre sometimes so destructive. The tense and turgid state of the prepuce, the escape of a dark sanies from under it, and the general vascular disturbance, point out the nature of the action, and the measures that are promptly to be put in force. When the glans is denuded by a division of the prepuce, a dark-brown or purple slough is seen involving a part of the glans or prepuce; and presenting no defined margin, but gradually terminating in a livid texture about to undergo the same change. So rapid is this action, sometimes, that in twenty-four hours it will have gained an inch on the sound structure. The difference between this and phagedænic action is, that in the latter the texture of the part affected retains its vitality, but not its integrity; while in the former, the reverse takes place; the circulation quickly ceasing, while the texture appears to undergo but little change, or even none, if the gangrenous action be rapid.

Whatever may be the cause of parts thus suddenly passing into a gangrenous state—whether the specific action of the poison, or common inflammation in a peculiar constitution—the disease is to be regarded as one of an inflammatory kind, requiring, especially in the commencement, vigorous antiphlogistic measures. A more fatal error cannot well be committed, than to stimulate these sores on the principle of supporting vital action. In looking back upon the cases of black slough that I have treated, I have never had occasion to regret having used early active depletion; and on the other hand, when the action has not been stopped, it has been from depletion

having been either not carried far enough, or not early enough adopted. The loss of blood, by division of the prepuce, is often sufficient to arrest the inflammation, independently of the good the operation occasions by exposure of the unsound part; and it is well to encourage the bleeding to the extent the patient's power will permit. One active depletion will also prevent secondary hemorrhage —an accident that may occur with benefit to the patient: but if happening when the disease is advanced, and the patient's powers low, it tends rather to spread the gangrenous disposition, than to check it. The sore should be freely exposed, and dressed with lint steeped in the compound tincture of benzoin; which is more effective in the dark than even in the white slough, for the arrest of the sloughing action, and separation of the dead mass. It is seldom necessary to seek the aid of any other local application; as this is more to be relied upon than the chlorides of lime or soda, or the carrot-and-yeast poultices, which are also useful, or than the balsams. As soon as depletion has been carried far enough, and the inflammatory state checked, the slough is usually cast off with rapidity; and a healthy surface, altogether free from syphilitic appearance, is established. If the sloughing action has been active and extensive in its operations, it removes all the parts involved in the specific action of the poison: hence mercury is seldom required in the granulating stage of these sores, and secondary symptoms are not often to be apprehended.

The heads at the beginning of this paper, which I have not touched upon, I reserve for another notice.

REPORT

ON THE

PHYSIOLOGY OF THE NERVOUS SYSTEM.

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Introduction.—The science of Physiology has for its object to ascertain, to analyse, and to classify, the qualities and actions which are peculiar to living bodies. These vital properties reside exclusively in organised matter, which is characterised by a molecular arrangement, not producible by ordinary physical attractions and laws. Matter thus organised consists essentially of *solids*, so disposed into an irregular network of laminæ and filaments, as to leave spaces occupied by *fluids* of various natures. "Texture," or "tissue," is the anatomical term by which such assemblages are distinguished. Of these the cellular, or *tela cellulosa*, is most elementary, being the sole constituent of several, and a partial component of all tissues and systems. Thus the membranes and vessels consist entirely of condensed cellular substance; and even muscle and nerve are resolvable, by microscopic analysis, into globules deposited in attenuated cellular element.

But though the phenomena, which are designated as vital, are never found apart from organisation, and have even by some naturalists been regarded as identical with it, yet in the order of succession vital actions seem necessarily to stand to organised structures in the relation of antecedents; for the production of even the most rudimentary forms and textures implies the previous operation of combining tendencies or "vital affinities." The origin and early development of these vital tendencies, and of organised structures, are beyond the pale of exact or even of approximative knowledge. But it is matter of certainty, that life is the product only of life; that every new plant or animal proceeds from some pre-existent being of the same form and character; and thus that the image of the great Epicurean poet, "Quasi cursores vitai lampada tradunt,"

[1] Report of the third meeting of the British Association, p. 59.

[We publish this Report at the the request of the chairman of the Committee of Publication of the Medical Society of the State of New York. It is referred to in connection with their proposed prize question on the Physiology of the Nervous System, and is accessible to but few.—Ed.]

possesses a compass and force of illustration which, as a supporter of the doctrine of fortuitous production, he could not have himself contemplated.

The popular notions respecting life are obscure and indeterminate; nor are the opinions even of philosophers characterised by much greater distinctness or mutual accordance. Like other complex terms, "life" can obviously be defined only by an enumeration of the phenomena which it associates. This enumeration will comprehend a greater or a smaller number of particulars, according to the station in the scale of living beings which is occupied by the object of survey. In its simplest manifestation, the principle of life may be resolved into the functions of nutrition, secretion, and absorption. It consists, according to Cuvier, of the faculty possessed by certain combinations of matter, of existing for a certain time, and under a determinate form, by attracting unceasingly into their composition a part of surrounding substances, and by restoring portions of their own substance to the elements. This definition comprehends all the essential phenomena of vegetable life. Nutritive matter is drawn from the soil by the spreading fibres of the root, through the instrumentality of spongioles or minute turgid bodies at their extremities, which act, according to Dutrochet, by a power which he has called "endosmosis." The same agency raises the nutrient fluid through the lymphatic tubes to the leaves, where it seems to undergo a kind of respiratory process, and becomes fit for assimilation. These changes, and the subsequent propulsion of the sap to the different parts and textures, plainly indicate independent fibrillary movements, which are represented in animal life by what Bichat has termed "the phenomena of organic contractility." The power residing in each part of detecting in the circulating fluid, and of appropriating, matters fitted to renovate its specific structure, is designated in the same system by the term "organic sensibility."

Ascending from the vegetable to the animal kingdom, the term "life" advances greatly in comprehensiveness. The existence of a plant is limited to that portion of space in which accident or design has inserted its germ; while animals are for the most part gifted with the faculties of changing their place, and of receiving from the external world various impressions. Along with the general nutritive functions, the higher attributes of locomotion and sensation are therefore comprised in the extended compass of meaning which the term "life" acquires with the prefix "animal." The nutritive functions, too, emerging from their original simplicity, are accomplished by a more complex mechanism, and by agencies further removed from those which govern the inanimate world.

Locomotion is effected either by means of a contractile tissue, or of distinct muscular fibres. These fibres have been said to consist of globules resembling, and equal in magnitude to, those of the blood, disposed in lines, in the elementary cellulosity, which, by an extension of the analogy, is compared to serum. But the latest

microscopical observations of Dr. Hodgkin are opposed to this globular constitution of the contractile fibre. "Innumerable very minute but clear and fine parallel lines or striæ may be distinctly perceived, transversely marking the fibrillæ." Irritability, or the faculty of contracting on the application of a stimulant, is a property inherent in the living fibre. It is an essential element of all vital operations, except of those which have their seat in the nervous system, such as sensation, volition, the intellectual states, and moral affections. All the phenomena of life, in the higher animals, may then be ultimately resolved into the single or combined action of these two elementary properties—irritability and nervous influence, each residing in its appropriate texture and system.

These preliminary remarks are designed to unfold the principles to be followed in classifying the vital functions. In general or comparative physiology, a strictly scientific arrangement would contemplate first the phenomena of the most elementary life, and would successively trace the more perfect developement of those simple actions and their gradual transition into more complex processes, as well as the new functions, superadded in the ascending scale of endowment. But such a mode of classification is wholly inapplicable to the particular physiology of man and of the more perfect animals, viewed by itself, and without reference to inferior orders of beings; for the nutritive functions of this class, which correspond with the elementary actions of the simplest vegetable life, are effected by a complex system of vessels and surfaces, deriving their vital powers from contractile fibres, and controlled, if not wholly governed, by nervous influence. It is then manifest, that in the higher physiology the general laws of contractility and "innervation" must precede the description of the several functions, which all depend on their single or united agency. The particular functions will afterwards be classed, as they stand in more immediate relation to one or other of the two essential principles of life.

In the present state of physiological knowledge, it is impossible to determine absolutely, and without an opening to controversy, whether the functions of muscle or those of nerve are entitled to precedency. If each were equally independent of the other in the performance of their several offices, the question of priority would resolve itself into one of simple convenience. The actions of the nervous system, if contemplated for the short interval of time during which they are capable of persisting without renovation of tissue, are entirely independent of the contractile fibre. But it is certain that the co-operation of nerve is required in most, if not in all, the actions of the muscular system. Thus the voluntary muscles in all their natural and sympathetic contractions receive the stimulant impulse of volition through the medium of nerve; and though the mode in which the motive impression is communicated to the involuntary muscles is still matter of controversy, there

seems sufficient evidence[1] to sanction the conclusion that nerve is in this case also the channel of transmission;—"that the immediate antecedent of the contraction of the muscular fibre is universally a change in the ultimate nervous filament distributed to that fibre." If this be correct, the physiological history of muscle cannot be rendered complete without reference to that of nerve.

In the higher manifestations of life, nervous matter is invested with the most eminently vital attributes. It is the exclusive seat of the various modes of sensation, and of all the intellectual operations; or, rather, it is the point of transition, where the physical conditions of the organs, which are induced by external objects, pass into states of mind, becoming perceptions; and where the mental act of volition first impresses a change on living matter. These two offices, of conducting motive impressions from the central seat of the will to the muscles, and of propagating sensations from the surface of the body and the external organs of sense to the sensorium commune, have been of late years shown to reside in distinct portions of nervous substance.

The honour of this discovery, doubtless the most important accession to physiological knowledge since the time of Harvey, belongs exclusively to Sir Charles Bell. It constitutes, moreover, only a part of the new truths, which his researches have unveiled, regarding the general laws of nervous action, and the offices of individual nerves. His successive experiments on function, guided always by strong anatomical analogies in structure, in origin, or in distribution, have led to the entire remodelling of nervous physiology, and to the formation of a system of arrangement, based on essential affinities and on parity of intimate composition, instead of on *apparent* sequence or proximity of origin. Among the continental anatomists, MM. Magendie and Flourens have contributed most largely to our knowledge of this part of physiology; the former by repeating and confirming the experiments of Bell, as well as by various original inquiries; the latter by his important researches into the vital offices of the brain and its appendages. Much light, too, has been thrown on the functions of several of the encephalic nerves, and especially of those supplying the face and its connected cavities, by Mr. Herbert Mayo, who has analysed their anatomical composition, and pursued their course with singular precision, and has thus been enabled to correct some errors of detail in the system of Sir Charles Bell.

Nervous System.—In man, and in other vertebrated animals, the nervous system consists of the cerebrum, cerebellum, medulla oblongata, medulla spinalis, and of the encephalic, spinal, and ganglionic nerves. It seems most natural to observe this order of anatomical sequence in recording what is known of nervous functions.

[1] See "A Critical and Experimental Inquiry into the Relations subsisting between Nerve and Muscle," in the 37th vol. of the Edinburgh Medical and Surgical Journal.

Cerebrum, or Brain-proper.—The physiology of the brain has received of late years very considerable accessions, and its vital offices, *viewed as an entire organ*, have now probably been ascertained with sufficient precision. Some portion of this newly acquired knowledge has been gathered from experiments on living animals, but the greater and more valuable part has flowed from the study of comparative developement. In this latter field of inquiry, Tiedmann's elaborate history of the progressive evolution of the human brain during the period of fœtal existence, with reference to the comparative structure of that organ in the lower animals, merits an early and detailed notice. It had been discovered by Harvey, that the fœtus in the human species, as well as in inferior animals, is not a precise facsimile of the adult, but that it commences from a form infinitely more simple, and passes through several successive stages of organisation before reaching its perfect developement. In the circulatory system, these changes have been minutely observed and faithfully recorded.[1] Tiedemann has traced a similar progression in the brain and nervous system, and has moreover established an exact parallel between the *temporary* states of the fœtal brain in the periods of advancing gestation, and the *permanent* developement of that organ at successive points of the animal scale. The first part of his work is simply descriptive of the nervous system of the embryo at each successive month of fœtal life. It constitutes the anatomical groundwork upon which are raised the general laws of cerebral formation, and the higher philosophy of the science. In the second part, Tiedemann has established, by examples drawn from all the grand divisions of the animal kingdom, the universality of the law of formation, as traced in the nervous system of the human fœtus, and the existence of one and the same fundamental type in the brain of man and of the inferior animals.

The facts which have been unfolded by the industry of Tiedemann, besides leading to the universal law of nervous developement, throw important light upon nervous function: for it is observed that the successive increments of nervous matter, and especially of brain, mark successive advances in the scale of being; and, in general, that the developement of the higher instincts and faculties keeps pace with that of brain. Thus, in the zoophyta, and in all living beings destitute of nerves, nothing that resembles an instinct or voluntary act is discoverable. In fishes the hemispheres of the brain are small, and marked with few furrows or eminences. In birds they are much more voluminous, more raised and vaulted than in reptiles; yet no convolutions or anfractuosities can be perceived on any point of their surface, nor are they divided into lobes. The brain of the mammalia approaches by successive steps to that of man. That of the rodentia is at the lowest point

[1] See an excellent Essay on the Developement of the Vascular System in the Fœtus of Vertebrated Animals, by Dr. Allen Thomson.

of organisation. Thus the hemispheres in the mouse, rat, and squirrel are smooth and without convolutions. In the carnivorous and ruminating tribes, the hemispheres are much larger and marked by numerous convolutions. In the ape tribe the brain is still more capacious and more convex; it covers the cerebellum, and is divided into anterior, middle, and posterior lobes. It is in man that the brain attains its greatest magnitude and most elaborate organisation. Sömmerring has proved that the volume of the brain, referred to that of the spinal marrow as a standard of comparison, is greater in man than in any other animal.

Various attempts have been made of late years, chiefly by the French physiologists, to ascertain the functions of the brain by actual experiment. It will appear from a detailed survey of their labours, that little more than a few general facts respecting the function of its *larger* masses and great natural divisions have flowed from this mode of research. The offices of the *smaller* parts of cerebral substance cannot with any certainty be derived from the phenomena that have been hitherto observed to follow the removal of those parts, since the most practised vivisectors have obtained conflicting results. Nor is it difficult, after having performed or witnessed such experiments, to point out many unavoidable sources of fallacy. In operations on living animals, and especially on so delicate an organ as the brain, it is scarcely possible for the most skilful manipulator to preserve exact anatomical boundaries, to restrain hæmorrhage, or prevent the extension to contiguous parts of the morbid actions consequent upon such serious injuries, and to distinguish the secondary and varying phenomena, induced by the pressure of extravasated blood, or the spread of an inflammatory process, from those which are essential and primary. The ablation of small and completely insulated portions of brain must, then, be classed among the "agenda" of experimental physiology.

The most decisive researches, that have been hitherto instituted on the functions of the brain, are those of M. Flourens. His mode of operating was to remove cautiously successive thin slices of cerebral matter, and to note the corresponding changes of function. He commenced with the hemispheres of the brain, which he found might be thus cut away, including the corpora striata and thalami optici, without apparently occasioning any pain to the animal, and without exciting convulsive motions. Entire removal of the cerebrum induces a state resembling coma; the animal appears plunged in a profound sleep, being wholly lost to external impressions, and incapable of originating motion; it is deprived, too, according to Flourens, of every mode of sensation. Hence the cerebrum is inferred to be the organ in which reside the faculties of perception, volition and memory. Though not itself sensible, in the ordinary acceptation of the word,—that is, capable, on contact or injury, of propagating sensation,—yet it is the point where impressions made on the external organs of sense become objects of perception. This

absence of general sensibility observed in the brain has also been experimentally demonstrated in the nerves dedicated to the functions of sight, of smell and of hearing, and constitutes, perhaps, one of the most remarkable phenomena that have been disclosed by interrogating living nature. Flourens appears, however, to have failed in proving that *all* the sensations demand for their perception the integrity of the brain. He has himself stated that an animal deprived of that organ, when violently struck, "has the air of awakening from sleep," and that if pushed forwards, it continues to advance after the impelling force must have been wholly expended. Cuvier has therefore concluded, in his Report to the Academy of Sciences upon M. Flourens' paper, that the cerebral lobes are the receptacle in which the impressions made on the organs of sight and hearing only, become perceptible by the animal, and that probably there too all the sensations assume a distinct form, and leave durable impressions,—that the lobes are, in short, the abode of memory. The lobes, too, would seem to be the part in which those motions which flow from spontaneous acts of the mind have their origin. But a power of effecting regular and combined movements, on *external stimulation*, evidently survives the destruction of the cerebral hemispheres.

A very elaborate series of experiments on the functions of the brain in general, and especially on those of its anterior portion, have been since performed by M. Bouillaud.[1] That observer concurs with Flourens in viewing the cerebral lobes as the seat of the *remembrance* of those sensations which are furnished to us by sight and hearing, as well as of all the intellectual operations to which these sensations may be subjected, such as comparison, judgment and reasoning. But he proves that the ordinary tactual sensibility does not require for its manifestation the presence of the brain. For animals entirely deprived of brain were awakened by being struck, and gave evident indications of suffering when exposed to any cause of physical pain. Bouillaud observes, too, that the iris continues obedient to the stimulus of light, after ablation of the hemispheres, and on this ground calls in question the loss of vision asserted by Flourens. Nor are the lobes (he contends) the only receptacle of intelligence, of instincts and of volition: for to admit this proposition of Flourens would be to grant that an animal which retains the power of locomotion, which makes every effort to escape from irritation, which preserves its appropriate attitude, and executes the same movements after as before mutilation, may perform all those actions without the agency of the will or of instinct. Another doctrine of Flourens, which has been experimentally refuted by Bouillaud, is, "that the cerebral lobes concur *as a whole* in the full and entire exercise of their functions; that when one sense is lost, all are lost; when one faculty disappears, all disappear;" in short, that a certain amount of cerebral matter may be cut away without appa-

[1] Magendie, Journal de Physiologie, tom. x. p. 36.

rent injury, but that when this limit is passed, all voluntary acts and all perceptions perish simultaneously. Bouillaud, on the contrary, has described several experiments which show that animals, from whom the anterior or frontal part of the brain had been removed, preserved sight and hearing, though deprived of the knowledge of external objects, and of the power of seeking their food.

The second part of M. Bouillaud's researches is entirely devoted to the functions of the anterior lobes of the brain. These were either removed by the scalpel, or destroyed by the actual cautery, in dogs, rabbits and pigeons. Animals thus mutilated feel, see, hear and smell; are easily alarmed, and execute a number of voluntary acts, but cease to recognise the persons or objects which surround them. They no longer seek food, or perform any action announcing a combination of ideas. Thus the most docile and intelligent dogs lost all power of comprehending signs or words which were before familiar to them, became indifferent to menaces or caresses, were no longer amenable to authority, and retained no remembrance of places, of things, or of persons. They saw distinctly food presented to them, but had ceased to associate with its external qualities all perception of its relations to themselves as an object of desire. The anterior or frontal part of the brain is hence inferred to be the seat of several intellectual faculties. Its removal occasions a state resembling idiotism, characterised by loss of the power of discriminating external objects, which, however, co-exists with the faculties of sensation.

It will be unnecessary to describe fully in this place the experiments of Professor Rolando, of Turin, performed in 1809, and published in Magendie's *Journal*, tom. iii., 1823, since the more important of his facts have reference, not to the brain proper, but to the cerebellum. His paper certainly contains some curious anticipations of phenomena, since more accurately observed by Flourens and Magendie; yet, as regards the brain, properly so called, his results are vague and inconclusive. Accident, rather than a well matured design, seems to have directed what parts of the brain he should remove; and from having comprehended in the same injury totally distinct anatomical divisions, he has rendered it impossible to arrive at the precise function of any one part. Thus we are told that injury of the thalami optici and tubercula quadrigemina in a dog was followed by violent muscular contractions. Now all subsequent experimenters agree, that irritation of the thalami is incapable of inducing convulsive motions; and Flourens has proved that this property has its beginning in the tubercula,—an important fact, which Rolando, with a little more precision in anatomical manipulation, could scarcely have failed to discover.

Magendie has described[1] some curious experiments on the corpora striata, which, though closely analogous in their results to those on

[1] Journal de Physiologie, tom. iii. p. 376.

the cerebellum, have their proper place in this section. Removal of one corpus striatum was followed by no remarkable change; but when both had been cut away, the animal rushed violently forwards, never deviating from a rectilinear course, and striking against any objects in its way. In his lecture of February 7, 1828, Magendie, in the presence of his class, removed both corpora striata from a rabbit. The animal attempted to rush forwards, and, if restrained, appeared restless, continuing in the attitude of incipient progression. One thalamus opticus was then cut away from the same animal. The direction of its motion was immediately changed from a straight to a curved line. It continued for some time to run round in circles, turning towards the injured side. When the other thalamus was removed, the animal ceased its motions, and remained perfectly tranquil, with the head inclined backwards. These experiments, it may be observed, furnish no support to the opinions of MM. Foville and Pinel Grandchamps, who have assigned the anterior lobes and corpora striata as the parts presiding over the movements of the inferior extremities, and the postérior lobes and thalami as regulating the superior.

Cerebellum.—It may be regarded as nearly established by modern researches, that the cerebellum is more or less directly connected with the function of locomotion. The precise nature and extent of its control over the actions of the voluntary muscles are, however, far from being clearly determined. In the higher animals, the mental act of volition probably has its commencing point, as productive of a physical change, in the brain proper; though it must be confessed that some of the experiments of Flourens, and all of those of Bouillaud, indicate the persistence of many instinctive, and even of some automatic motions, after destruction of the brain. But there *does* appear sufficient evidence to prove that these volitions which have motion as their effect, whatever be their origin, whether in the cerebrum, cerebellum, or medulla oblongata,[1] require for their accomplishment the co-operation of the cerebellum. This evidence has been mainly supplied by the same inquirers whose researches on the cerebrum have been already analysed.

In the order of time, though not of importance, the experiments of Professor Rolando stand foremost. Injuries of the cerebellum, he observed, were always followed by diminished motive power; and this partial loss of power was always in direct proportion to the amount of injury. A turtle survived upwards of two months the entire removal of the cerebellum, continuing sensible to the slightest stimulus; but when irritants were applied, it was totally unable to move from its place. M. Flourens has since arrived at similar, but more definitive results. He removed in succession thin slices from the cerebellum. After the first two layers had been cut away, a slight weakness and want of harmony and system in the automatic movements were noticed. When more cerebellic substance

[1] Flourens, Mémoires de l'Académie, tom. ix.

had been removed, great general agitation became apparent. The pigeon which was the subject of operation retained, as at first, the senses of sight and hearing, but was capable of executing only irregular unconnected muscular efforts. It lost by degrees the power of flying, of walking, and even of standing. Removal of the whole cerebellum was followed by the entire disappearance of motive power. The animal, if laid upon its back, tried in vain to turn round; it perceived and was apprehensive of blows, with which it was menaced, heard sounds, seemed aware of danger, and made attempts to escape, though ineffectually,—in short, while it preserved, uninjured, sensation and the exercise of volition, it had lost all power of rendering its muscles obedient to the will. The cerebellum is hence supposed by Flourens to be invested with the office of "balancing, regulating or combining separate sets of muscles and limbs, so as to bring about those complex movements depending on simultaneous and conspiring efforts of many muscles, which are necessary to the different kinds of progressive motion." Bouillaud, who has successfully disputed several of the opinions of Flourens respecting the functions of the cerebrum, fully concurs with him as to those of the cerebellum.

Yet, it must be admitted, that there exists also conflicting experimental testimony on this subject. M. Fodera[1] states, that he has found the removal of a part of the cerebellum to be followed, in all cases, either by motion *backwards*, or by that position of the body which precedes retrograde movement. The head is thrown back, the hind-legs separated, and the fore-legs extended forwards, and pressed firmly against the ground. More complete destruction of the cerebellum occasions the animal to fall on its side; but the head is still inclined rigidly backwards, and the anterior extremities agitated with convulsive movements, tending to cause retrograde motion of the body. Injuries of one side of the cerebellum were observed to produce paralysis of the same side of the body; as might, indeed, have been anticipated from the direct course, without decussation, of the restiform columns which ascend to form the cerebellum. Magendie has described[2] precisely the same results. A duck, whose cerebellum had been destroyed, could swim only backwards. In the course of his experimental lectures, Magendie, having removed the cerebellum in several rabbits, demonstrated to his class the phenomena of retrograde movement, exactly as they have been recorded by Fodera. It is then impossible to regard the conclusions of Flourens as fully established, opposed as they are by those of so skilful an experimenter as Magendie. Indeed, while Flourens conceives the cerebellum to preside over motion, MM. Foville and Pinel Grandchamps attribute to it the directly opposite function of sensation: and this doctrine seems to derive some support from anatomical disposition; for it has been proved by Tiedemann that the cerebellum is nothing more than an expansion or

[1] Journal de Physique, July, 1823. [2] Ibid. tom. iii. p. 157.

prolongation of the corpora restiformia, and posterior columns of the spinal medulla, which columns have been shown by Sir Charles Bell to have the office of conveying sensations. But it is not the less true that all recent experiments, even those of Fodera and Magendie, point to some connection between the cerebellum and the power of voluntary motion. In the present state of our knowledge, it would be unsafe to contend for more than the probable existence of some such general relation.

This, then, is all that seems deserving of confidence respecting the functions of the cerebellum itself. But there are some singular phenomena which, though residing in other structures more or less near to the cerebellum, are so analogous to those already described as to call for notice in this place. Magendie has described[1] the results of injury to the crura cerebelli of a rabbit. Complete division of the right crus was followed by rapid and incessant rotation of the body upon its own axis, from left to right. This singular motion having continued two hours, Magendie placed the rabbit in a basket containing hay. On visiting it the following day, he was surprised to find the animal still turning round as before, and completely enveloped in hay. The eyes were rigidly fixed in different lines; that of the injured side being directed forwards and downwards, that of the other side backwards and upwards. If both crura were divided, no motion followed. Magendie hence concluded, that these nervous cords are the conductors of impulsive forces which counterbalance one another, and that from the equilibrium of these two forces result the power of standing, and even of maintaining a state of rest, and of executing the different voluntary motions. The inquiry naturally presented itself, whether these forces are inherent in the crura themselves, or emanate from the cerebellum or some other source. To determine this question, portions of substance were removed from both sides of the cerebellum, but unequally, so as to leave intact $\frac{3}{4}$ on the left side, and $\frac{1}{4}$ only on the right. The animal rolled towards the right side, and its eyes were fixed in the manner already described. But the left crus being divided, the animal rolled to the left side. Hence it appears that section of the crus has more influence over the lateral rotation of the body than injury of the cerebellum itself; and that the impulsive force does not belong (at least exclusively) to the cerebellum. When the cerebellum was divided precisely in the median line, the animal seemed suspended between two opposing forces, sometimes inclining towards one side, as if about to fall, and again thrown suddenly back to the opposite side. Its eyes were singularly agitated, and seemed about to start from the orbits. Similar movements followed division of the continuous fibres in the pons Varolii. Serres has described a case of similar rotatory motion occurring in the human subject. A shoemaker, habituated to excess in alcoholic liquors, after great intemperance, was seized with an irresistible disposition

[1] Journal de Physiologie, tom. iv. 399.

to turn round upon his own axis, and continued to move so till death ensued. On inspecting the brain, one of the crura cerebelli was found much diseased, and this was the only alteration of structure visible in any part of the nervous system.

M. Flourens has published in a recent volume of the *Mémoires de l'Académie des Sciences*[1] a description of some striking abnormal motions which followed the division of the semicircular canals of the ears of birds. Though these organs have no anatomical relation to the cerebrum or cerebellum, the altered motions resulting from their division are so analogous to those observed by Magendie after lesions of the corpora striata and crura, that they may be most conveniently described in the same section. Two of the semicircular canals are vertical, and one horizontal. Division of the horizontal canals on each side occasioned a rapid horizontal movement of the head from right to left, and back again, and loss of the power of maintaining an equilibrium, except when standing, or when perfectly motionless. There was also the same singular rotation of the animal round its own axis, which follows injury of the crura cerebelli. Section of the inferior vertical canal on both sides produced violent vertical movements of the head, with loss of equilibrium in walking or flying. There was in this case no rotation of the body upon itself, but the bird fell backwards, and remained lying on its back. When the superior vertical canals were divided, the same phenomena were observed as in section of the inferior, except that the bird fell forward on its head, instead of backward. All the canals, both vertical and horizontal, having been divided, in another pigeon, violent and irregular motions in all directions ensued. When, however, the bony canals were so cautiously divided as to leave their internal membranous investment uninjured, these abnormal motions were not produced. It is, therefore, in these membranes, or rather in the expansion of the acoustic nerve which overspreads them, that the cause of this phenomenon must reside. No explanation is proposed by Flourens of the control thus exercised by a nerve supposed to minister exclusively to the sense of hearing, over actions so entirely opposite in character. It is remarkable that the irregular movements should observe the same direction in their course as the canals, by the section of which they are induced. Thus the direction of the inferior vertical canal is posterior, that of the superior is anterior, corresponding perfectly with the directions of the abnormal motions.

Medulla Oblongata.—The medulla oblongata, or "bulbe rachidien," is reducible into six columns, or three pairs, viz., two anterior or pyramidal, which partially decussate, two middle or olivary, and two posterior or restiform, which proceed forwards without crossing. It is continuous in structure with the spinal marrow, and enjoys, by virtue of this relation, the same function of propagating motion and sensation. But it is distinguished from the spinal medulla by

[1] Tom. ix. p. 454.

special and higher attributes, being endowed with the faculty of originating motions, as well as with that of regulating and conducting them. The medulla oblongata, with the cerebrum and cerebellum, constitute, in short, according to Flourens,[1] those portions of the nervous system which exercise their functions "spontaneously or primordially," and which originate and preside over the vital actions of the subordinate parts. To this latter order of parts, which require an exciting or regulating influence, belongs the spinal medulla. In the superior class, Flourens seems to assign even a higher place to the medulla oblongata than to the cerebrum or cerebellum. For the cerebrum, he observes, may act without the cerebellum; and this latter organ continues to regulate the motions of the body after removal of the cerebrum. But the functions of neither cerebrum nor cerebellum survive the destruction of the medulla oblongata, which seems to be the common bond and central knot combining all the individual parts of the nervous system into one whole.

The medulla oblongata was regarded by Legallois as the mainspring or "premier mobile" of the inspiratory movements. He repeated before a commission of the Institute of France the leading experiments on which his opinion rested.[2] In a rabbit, five or six days old, the larynx was detached from the os hyoides and the glottis exposed to view. The brain and cerebellum were then extracted without arresting the inspirations, which were marked by four simultaneous motions,—a gaping of the lips, an opening of the glottis, the elevation of the ribs, and the contraction of the diaphragm. Legallois next removed the medulla oblongata, when all these motions ceased together. In a second rabbit, instead of extracting at once the entire medulla, it was cut away in successive thin slices. The four inspiratory movements continued after the removal of the three first slices, but ceased after the fourth. It was found that the fourth had reached the origin of the eighth pair of nerves. If, instead of destroying the part in which this motive influence resides, it be simply prevented from communicating with the muscles which are subservient to inspiration, a similar effect ought to be produced. Now it is obvious that the medulla oblongata must transmit its influence to the muscles which raise the ribs, through the medium of the intercostal nerves, and therefore of the spinal marrow, and to the diaphragm through the phrenic nerves, and to these through the spinal marrow. In another rabbit, therefore, the medulla spinalis was cut across about the level of the seventh cervical vertebra. The effect of this operation was to arrest the elevation of the ribs, the other three inspiratory motions still continuing. A second section was made near the first cervical vertebra, and consequently above the origin of the phrenic, with the effect of suspending the contraction of the diaphragm. The par vagum was next divided

[1] Mémoires de l'Académie des Sciences, tom. ix. p. 478.
[2] Œuvres de Legallois, tom. i. p. 247.

in the neck, and the opening of the glottis ceased. There remained then, of the four inspiratory movements, only the gaping of the lips, which, however, was sufficient to attest that the medulla oblongata still retained the power of producing them all. This power had ceased to call forth the other three motions, only because it no longer had communication with their organs.

M. Flourens, in a recent memoir already referred to,[1] has confirmed and extended the views first announced by Legallois. He has distinctly traced the comparative action of the medulla spinalis and oblongata, on respiration, in the four classes of vertebrated animals. In birds, he found that all the lumbar and the posterior dorsal medulla might be destroyed without impeding the respiratory function, though it was arrested by removal of the costal medulla. In the mammalia the costal also might be removed, for though the raising of the ribs ceased, the action of the diaphragm continued as long as the origin of the phrenic nerve remained uninjured. In frogs, all the spinal medulla may be destroyed, except the portion, whence spring the nerves supplying the hyoideal apparatus. Every part of the spinal marrow may be removed in fishes without affecting respiration; for all the nerves distributed to the respiratory organs of fishes have their origin in the medulla oblongata. It is hence apparent that the spinal marrow exercises only a variable and relative action on the respiratory function, in the different classes of vertebrated animals. In descending from the higher to the lower points of this scale, the spinal marrow is seen progressively to disengage itself from co-operation in these movements, while the medulla oblongata tends more and more to concentrate them in itself, till in fishes the proper functions of the two medullæ show themselves completely distinct, the spinal ministering to locomotion and sensation, and the oblongata to respiration. The medulla oblongata is then the "premier moteur," or the exciting and regulating principle of the inspiratory movements in all classes of vertebrated animals; besides participating, by virtue of its continuity with the spinal marrow, in the proper functions of that organ. From a second series of experiments, M. Flourens concludes, that there exists a point in the nervous centres at which the section of those centres produces the sudden annihilation of all the inspiratory movements; and that this point corresponds with the origin of the eighth pair of nerves, commencing immediately above, and ending a little below that origin—a result precisely agreeing with that obtained by Legallois.

Spinal Marrow.—It is apparent that the functions of the three grand divisions of the nervous system, already described, have not yet been distinctly and fully ascertained. Our knowledge of those, which next fall under survey, is more definite and substantial. The vital offices of the spinal medulla—regarded by Legallois as the mainspring of life, and as alone regulating the actions of the heart

[1] Mémoires de l'Académie, tom. ix. 1830.

and nobler organs,—are now reduced to conveying to the muscles the motive impulse of volition, and to propagating to the sensorium commune, impressions made on the external senses. It is not invested with the power possessed by the cerebrum and cerebellum, and perhaps by the medulla oblongata, of spontaneously originating muscular motions. It is mainly, if not exclusively, a *conductor;* a medium of communication between the brain and the external instruments of locomotion and sensation. Flourens, indeed, conjectures that it also has the office of associating the partial contractions of individual muscles into "mouvemens d'ensemble," necessary to the regular motions of the limbs.

Before recording what is known of the spinal cord itself, it will be proper to advert to some recent experiments of Magendie, on the serous fluid in which it is immersed. It would appear that a quantity of liquid, varying from two to five ounces in the human subject, is always interposed between the arachnoid tunic and the pia mater, or proper membrane of the cord. The intermembranous bag, occupied by this fluid, communicates with the ventricular cavities at the calamus scriptorius by a round aperture, often large and patent in hydrocephalic subjects. Magendie has therefore named this serous liquid "cerebro-spinal." In living animals, it issues in a stream from a puncture of the arachnoid. Its removal occasions great nervous agitation, and symptoms resembling those of canine madness. The sudden increase of its quantity induces coma. Its presence seems essential to the undisturbed and natural exercise of the nervous functions; and this influence probably is dependent upon its pressure, temperature, and chemical constitution, since any variation of these conditions is followed by the phenomena of nervous disorder.

The great medullary cord is divided by a double furrow into two lateral halves: and each of these is again subdivided by the insertions of the ligamenta dentata into two columns, one posterior and one anterior. It has been long known that section of any part of the spinal marrow excludes from intercourse with the brain all those parts of the body, which derive their nerves from the cylinder of medulla *below* the point of injury. The muscles, so supplied, are no longer obedient to the control of the will, and the tegumentary membranes similarly situated entirely lose their sensibility. This interruption of the relations which subsist between the central seat of volition and sensation, and the rest of the body, whether due to direct injury of the great nervous masses or communicating nerves, or produced by the pressure of extravasated fluids, by morbid growths, or by various poisonous matters, constitutes the condition known by the name "paralysis." In cases of this kind it is frequently observed that the powers of sensation and locomotion are simultaneously impaired or destroyed. But examples are not wanting, even in the earliest clinical records, of the total loss of one of those faculties with perfect integrity of the other. Such facts naturally suggested the belief that the power of propagating sensa-

tions, and that of conveying motive impressions, resided in distinct portions of the nervous system. This opinion, however, remained mere matter of conjecture until a recent period, when it was unequivocally established by Sir Charles Bell. From the original experiments of that most distinguished physiologist, repeated and confirmed by Magendie, it follows that the faculty of conducting sensations resides exclusively in the two posterior columns of the medulla, while that of communicating to the muscular system the motive stimulus impressed by volition is the attribute of the two anterior columns. The same limitation of function is found in the nervous roots which spring from these separate columns. Thus each spinal nerve is furnished with a double series of roots, one set of which have their origin in the anterior medullary column, and one in the posterior. The spinal nerves are, in consequence of this anatomical composition, nerves of twofold function, containing in the same sheath distinct continuous filaments from both columns, and exercising, in the parts to which they are distributed, the double office of conductors of motion and sensation. It will afterwards appear, in our history of individual nerves, that all those which spring from the brain, except the fifth and eighth pairs, possess only a single function.

Sufficient experimental proof of the foregoing propositions has been furnished by Sir Charles Bell and by M. Magendie. Thus, division of the posterior roots of the spinal nerves is uniformly followed by total absence of feeling in the parts of the body to which the injured nerves are distributed, while their motive power remains undiminished. Magendie has further observed, that if the medullary canal be laid open, and the two posterior cords be touched or pricked slightly, there is instant expression of intense suffering; whereas, if the same or a greater amount of irritation be applied to the anterior columns, there are scarcely any signs of excited sensibility. The central parts of the medulla seem also nearly impassable.[1] They may be touched, and even lacerated, according to Magendie, without exciting pain, if precautions are taken to avoid the surrounding medullary substance. In general, the properties of the spinal marrow, and especially its sensibility, seem to reside mainly on its surface; for slight contact, even of the vascular membranes covering the posterior columns, caused acute pain.

The first experiment of Sir C. Bell consisted in laying open the spinal canal of a living rabbit, and dividing the posterior roots of the nerves that supply the lower limbs. The animal was able to crawl. In his second trial he first stunned the rabbit, and then exposed the spinal marrow. On irritating the posterior roots, no motion was induced in any part of the muscular frame; but on grasping the anterior roots, each touch of the forceps was followed by a corresponding contraction of the muscles supplied by the

[1] Annales de Chimie et de Physique, tom. xxiii. p. 436.

irritated nerve. Magendie has described[1] the following experiments, which he has since declared were made without any knowledge of the prior ones of Sir C. Bell. The subjects chosen for the operation were puppies about six weeks old, for in these it was easy to cut with a sharp scalpel through the vertebræ and to expose the medulla. In the first, the posterior roots of the lumbar and sacral nerves were divided, and the wound closed: violent pressure, and even pricking with a sharp instrument, awakened no sensation in the limb supplied by the nerves which had been cut; but the motive power was uninjured. A second and a third trial gave the same results. Magendie then divided in another animal, though with some difficulty, the anterior roots of the same nerves on one side. The hind limb became flaccid and entirely motionless, though it preserved its sensibility. Both the anterior and posterior roots were cut in the same subject with destruction of motion and sensation. In a second paper[2] Magendie has related the following additional facts. The introduction of nux vomica into the animal economy is well known to give rise to violent tetanic convulsions of the whole muscular system. This property was made available as a test of the functions of the separate orders of nervous roots. It was found that, while all the other muscles of the body were agitated, when under the influence of this poison, by violent spasmodic contractions, the limb, supplied by nerves whose anterior roots had been previously divided, remained supple and motionless. But when the posterior roots only had been cut, the tetanic spasms were universal. It would seem, however, that the seats of the two faculties of conducting motion and sensation are not strictly insulated by exact anatomical lines, but that they rather pass into each other with rapidly decreasing intensity. Thus irritation of the *anterior* roots, when connected with the medulla, gives birth, along with motive phenomena, to some evidences of sensibility; and, *vice versâ*, stimuli applied to the posterior roots, also undivided, occasion slight muscular contractions. In this last case it is, indeed, probable that the irritation travelled from the posterior roots upwards to the brain in the accustomed channel, and gave rise to a perception of pain, which prompted the muscular effort. Indeed, after division of the posterior nervous roots, ordinary stimulants, applied to the ends not connected with the medulla, produced no apparent effects; though the galvanic fluid directed upon either order of roots, gave rise to muscular contractions. These were more complete and energetic when the anterior roots were the subjects of the experiment.

Besides the evidence thus obtained by direct experiments on living animals, several important facts have been gathered from the pathology of the nervous system in man. These consist of cases of insulated paralysis of either motion or feeling, referred to the changes in structure observed after death. Sir Charles Bell has himself

[1] Journal de Physiologie, tom. ii. p. 276. August, 1822.
[2] Ibid, tom. ii. p. 366.

recorded several examples of this kind strongly confirming his experimental results; and others of similar tendency are scattered through the successive volumes of Magendie's Journal.[1] But it must be admitted, that evidence of this kind is seldom distinct and conclusive. The structural changes, induced by disease, are rarely so circumscribed in seat and extent as to represent adequately the operations of the scalpel; and often when they are thus isolated within anatomical bounding lines, they affect, by pressure, or by the spread of the same morbid process, in a degree too slight to leave decided traces, the functions of contiguous parts, thus clouding the judgments of the best pathologists, and invalidating their inferences. There is, however, a very remarkable case described by Professor Royer Collard, to which these objections do not apply. Sprévale, an invalided soldier, was upwards of seventeen years the subject of medical observation in the Maison de Santé of Charenton. This individual remained for the last seven years of his life with the legs and thighs permanently crossed, and totally incapable of *motion*, though retaining their sensibility. On opening after death the spinal canal, there was found the pultaceous softening (*ramollissement*) of the whole *anterior* part of the medulla, and of almost the whole of the fibrous cords which form it. The *anterior* roots of the spinal nerves had also lost their accustomed consistency; while the posterior surface of the spinal cord, and its investing membrane, were healthy. Several of the cases observed by Sir Charles Bell furnish also unequivocal proof of the soundness of the views developed by experiment.

There exist, indeed, few truths in physiology established on so wide and solid a basis of experimental research and pathological observation, as those deduced by Sir Charles Bell, the original discoverer, and by Magendie, his successor in the path of inquiry, respecting the offices of the spinal medulla. This organ may now be regarded as mainly, if not solely, a medium of intercourse between the external world and the brain, and again between the brain and the voluntary muscles, its two anterior columns being subservient to motion, its two posterior to sensation. In the present state of our knowledge, it would be fruitless to try to penetrate into the minute philosophy of these actions: but it seems probable, from recent discoveries on the ultimate anatomy of tissue, that these actions are molecular, having their place in the globular elements, into which all living textures are resolvable by microscopic analysis;—that the physical changes, *e. g.* impressed by external objects on the delicate net-work of nerve which invests the tegumentary membranes and open cavities, are propagated thence, from particle to particle, along the continuous filaments, to their origins in the posterior spinal columns, and thence to the central point, where they become objects of perception;—and that the motive

[1] See in particular Dr. Rullier's case, tom. iii. p. 173; and Dr. Koreff's, tom. iv. p. 376.

stimulus of volition is similarly transmitted down the anterior columns and nerves, to the organs of locomotion. Indeed, it is a legitimate inference from Sir Charles Bell's discoveries, that a simple nervous filament, or medullary column, can only propagate an impression in one line of direction, viz., either towards or from the central seat of perception and of will; and this curious law of nervous actions would seem to point at some insensible molecular *motion* as their essential condition.

It remains to investigate the arguments which have been supposed to prove the residence in the spinal marrow of the power of originating and controlling the actions of the heart. This question has been matter of eager controversy, from its bearing upon the general relations of nerve and muscle. Without prejudging this latter topic, it may simplify its future consideration, and will at the same time be more consistent with strict arrangement, to state here merely the facts which have reference to the spinal medulla.

The work of Legallois, entitled "Expériences sur le Principe de la Vie, notamment sur celui des Mouvemens du Cœur et sur le Siége de ce Principe,"[1] was the first remarkable essay on the relations between the heart and the spinal cord. It will, however, be sufficient to allude in general terms to the conclusions of Legallois, since they have been entirely subverted by the subsequent researches of Dr. Wilson Philip and M. Flourens. Legallois's main doctrine was, that the principle which animates each part of the body resides in that part of the spinal medulla whence its nerves have their origin; and that it is also from the spinal cord that the heart derives the principle of its life and its motion.[2] The experimental proof supposed to establish these propositions consisted in destroying in different rabbits portions of the cervical, dorsal and lumbar medulla. Cessation of the heart's action was affirmed to be the constant result of the operation; but even in some of Legallois's own experiments,[3] the motions of the heart continued after considerable injury had been inflicted on the spinal cord, and especially on its lower divisions. Still more unequivocal is the evidence that has been advanced by Dr. Wilson Philip, in his Inquiry into the Laws of the Vital Functions. His experiments, which were very numerous and judiciously varied, show that the circulation continues long after entire removal of the spinal marrow, and that by artificially maintaining respiration, the motions of the heart may be almost indefinitely prolonged. Flourens, in the 10th vol. of the Mém. de l'Académie,[4] has lately confirmed Dr. Philip's views: he has shown that the circulation is entirely independent of the spinal marrow. The influence apparently exerted is only secondary, being due to the suspension of the respiratory movements. Thus all those portions of the spinal marrow which can be destroyed in

[1] Œuvres de Legallos, tom. i. pp. 97, 99, &c.
[2] p. 259.
[3] pp. 100, 101, 105.
[4] p. 625.

the different classes of animals without arresting respiration, may be removed without affecting the circulation. In fishes and frogs the entire spinal cord may be destroyed without checking the heart's motions, because in these classes the medulla oblongata presides exclusively over the respiratory function.

Nerves.—The classification of nerves, which is most convenient to the physiologist, is based upon their vital properties or functions. Such an arrangement would distribute them into—1, nerves of motion; 2, nerves both of motion and sensation; 3, the nerves ministering to the senses of sight, smell and hearing; and 4, the ganglionic system, or, according to Bichat, nerves of organic life. Sir Charles Bell has added a fifth class, comprising nerves which he supposes are dedicated to the respiratory motions. But it will afterwards appear, that the existence of an exclusive system of respiratory nerves is not supported by sufficient evidence.

The first class of nerves exercising the single office of conveying motion comprehends the 3d, 4th, 6th, portio dura of the 7th, the 9th, and perhaps two divisions of the 8th, viz. the glossopharyngeal and spinal accessory. Mr. H. Mayo's experiments, detailed in his Anatomical and Physiological Commentaries, No. 11. (and Journal de Physique, tom. iii.) throw much light on the functions of several of these nerves. The motions of the iris, he shows, require the integrity of the third pair, division of these nerves being always followed by full dilatation of the pupils, which cease to be obedient to the stimulus of light. If the divided end of the nerve communicating with the eye be pinched by the forceps, the iris contracts. Hence it is apparent that diminution of the aperture of the pupil is the result of action, and dilatation of the pupil the result of relaxation, of the iris. Flourens has shown that complete extirpation of of the tubercula quadrigemina also paralyses the iris, and that irritation of those bodies excites its contractions. The same effect is noticed by Mayo to arise from division or irritation of the optic nerve. He divided the optic nerves within the cranium of a pigeon immediately after decapitation. When the end of the nerve connected with the ball of the eye was seized in the forceps, no action ensued; but when the end attached to the brain was irritated, the iris immediately contracted. These several experiments clearly indicate the dependence of the iris upon the optic nerve, upon the tubercula from which one root of that nerve springs, and upon the third pair. The stimulus of light impinges upon the retina, is conveyed along the optic nerve through the tubercle to the sensorium, whence the motive impression is propagated to the iris by the third encephalic nerve.

It is not so easy to define the precise mode of action of the pathetici, or fourth pair of nerves. Sir Charles Bell[1] supposes that they are destined "to provide for the insensible and instinctive rolling of the eyeball, and to associate this motion of the eyeball with

[1] Natural System of Nerves, p. 358.

the winking motions of the eyelids." He even conjectures that "the influence of the fourth nerve is, on certain occasions, to cause a relaxation of the muscle to which it goes." It is certain, however, from its exclusive distribution to the superior oblique muscle, that the fourth is a nerve of motion. The sixth nerve is also a nerve of voluntary motion, and is sent to the rectus externus of the eyeball.

Sir Charles Bell has placed the portio dura of the seventh pair among his respiratory nerves. There is, however, no doubt that it is simply a motive nerve, and that it is indeed the only nerve of motion, which supplies all the muscles of the face, except those of the lower jaw and palate. Division of this nerve occasions no expression of pain, according to Bell; but Mayo's experience is opposed to this absence of sensibility.[1] "The motion of the nostril of the same side instantly ceased, after its section in an ass,[2] and that side of the face remained at rest and placid during the highest excitement of the other parts of the respiratory organs." These and similar observations are all consistent with the opinion, that the seventh is simply a nerve of voluntary motion. It will afterwards appear that it has no claim to any further endowment.

Mr. Herbert Mayo infers from his experiments, that the three divisions of the eighth pair are all nerves both of motion and sensation. Thus the glossopharyngeus is a nerve of motion to the pharynx, and perhaps of sensibility to the tongue. He observed that "on irritating the glossopharyngeal nerve in an animal recently killed, the muscular fibres about the pharynx acted, but not those of the tongue."[3] Irritation of the spinal accessory produced both muscular contractions and pain. The par vagum, he conceives, bestows sensibility on the membrane of the larynx, besides conveying the motive stimulus to its muscles. This nerve has been the subject of experiment from the earliest times, and Legallois has minutely described the results obtained by successive inquirers.[4] These were singularly discordant, and gave origin to the most opposite theories of the mode of action of the par vagum. In the greater number of experiments, section of this nerve was followed, after a longer or shorter interval, by death. Piccolhomini contended that the division of the nerve was fatal from its arresting the movements of the heart, and after him Willis supported the same doctrine. By Haller, on the contrary, the cause of death was sought in disturbance of the digestive functions. Bichat and Dupuytren seem to have been the first to obtain a glimpse of the true seat of injury. The former remarked that the respiration became very laborious after section of the nerve, and Dupuytren distinctly traced death to asphyxia. Legallois has established by numerous experi-

[1] See Mr. H. Mayo's Anatomical and Physiological Commentaries, Part I.; and Outlines of Human Physiology, 2d edit. p. 334.
[2] pp. 105, 107.
[3] Outlines of Human Physiology, 2d edit. p. 337.
[4] Œuvres, p. 154 et seq.

ments the accuracy of this last view. He has shown that in very young animals death is the immediate consequence of the operation of cutting either the par vagum or its recurrent branch, and that the suddenness of the effect is due to the narrowness of the aperture of the glottis in early age. In adult animals, the asphyxia is induced by the effusion of serous fluids and ropy discoloured mucus into the bronchial tubes and air-cells. More recently, Dr. Wilson Philip has practised the section of the par vagum with an especial reference to its influence upon digestion. He divided the nerve below the origin of the inferior laryngeal branch, as in this case the dyspnœa is much less considerable than when the wound is inflicted on the higher portion.[1] It was found, in all these trials, that food introduced into the stomach after the operation remained wholly undigested. Hence Dr. Philip infers the dependence of secretion upon nervous influence, a conclusion, it has been remarked by Dr. Alison, not logically deducible from the experimental data.[2]

The par vagum cannot then, it is obvious, be included in the class of nerves subservient solely to motion; and it is even doubtful whether the other two divisions of the eighth pair are not also endowed with sensibility. Respecting the function of the ninth, or lingual, there is, however, no place for hesitation. It has been experimentally proved by Mr. Mayo to supply the muscles of the tongue; though he also asserts, that pinching it with the forceps excited pain. Three of these nerves, the third, sixth, and ninth, arise, it was first remarked by Sir Charles Bell, from a tract of medullary matter continuous with the anterior column of the spinal marrow: and hence their exclusive office of conducting motive impressions.

II. There are thirty-two pairs of nerves of similar anatomical origin and composition, which possess the twofold office of communicating motion and sensation. Of these, all excepting one, (the fifth pair of the cerebral nerves,) spring from the spinal marrow. These thirty-one pairs are precisely analogous in formation, being all constituted of two distinct series of roots, one from the anterior column, and one from the posterior column of the spinal marrow. The posterior funiculi collected together form a ganglion, seated just before this root is joined by the anterior root. It has been already stated, that the power of propagating sensation resides in the posterior column, and in the nervous roots arising from it, and that the motive faculty has its seat in the anterior column and roots. The evidence, also, supplied by Bell and Magendie, that the spinal nerves are hence nerves of double office, has been fully detailed. It remains then to establish the title of the fifth pair of cerebral nerves to be included in the same class with the spinal nerves.

The analogy in structure and mode of origin between the fifth pair and the nerves of the spine, has been long matter of observa-

[1] Experimental Inquiry, 3d edit. p. 109.
[2] Dr. Alison, Journal of Science, vol. ix. p. 106.

tion. Prochaska has thus distinctly noticed it in a passage of his Essay De Structurâ Nervorum, published in 1779, first pointed out to me by my friend Dr. Holme: "Quare omnium cerebri nervorum, solum quintum par post ortum suum more nervorum spinalium, ganglion semilunare dictum, facere debet? sub quo peculiaris funiculorum fasciculus ad tertium quinti paris ramum, maxillarem inferiorem dictum, properat, insalutato ganglio semilunari, ad similitudinem radicum anteriorum nervorum spinalium?" Sömmering has also pointed out with equal clearness the resemblance in distribution between the smaller root of the fifth, and the anterior roots of the spinal nerves. But Sir Charles Bell was the first to establish the identity of their functions, and to arrange them prominently in the same natural division. His experiment consisted in exposing the fifth pair at its root, in an ass, the moment the animal was killed. "On irritating the nerve, the muscles of the jaw acted, and the jaw was closed with a snap. On dividing the root of the nerve in a living animal, the jaw fell relaxed." In another experiment, the superior maxillary branch of the fifth nerve was exposed. "Touching this nerve gave acute pain; . . . . . the side of the lip was observed to hang low, and it was dragged to the other side." Sir Charles Bell concluded, that the fifth nerve and its branches are endowed with the attributes of motion and sensation. This, though correct as regards the nerve itself, viewed as a whole, is strictly true only of the lowest of its three *divisions*, viz., the inferior maxillary. The ophthalmic and the superior maxillary, the subject of the last experiment, are nerves simply of sensation. Mr. Herbert Mayo, in the essay already referred to, has pointed out this error, and has defined with minute precision the relative offices of the fifth and seventh nerves. By a careful dissection of the fifth nerve, he found that the anterior branch, or smaller root, which goes, as Prochaska was aware, entirely to the inferior maxillary, is distributed exclusively to the circumflexus palati, the pterygoids, and temporal and masseter *muscles*. He observed that section of the supra and infra orbitar branches, and of the inferior maxillary, near the foramina, whence they emerge, induces loss of sensation in the corresponding parts of the face. It may then be regarded as fully proved, that the trigeminus or fifth pair is the nerve which bestows sensation on the face and its appendages, and motion only on the muscles connected with the lower jaw. The other muscles of the face derive their motive power from the portio dura of the seventh nerve.

M. Magendie has also published several memoirs on the functions of the fifth pair. In these he attempts to prove that the olfactory nerve is not the nerve of smell; that the optic is but partially the nerve of vision; and that the auditory is not the principal nerve of hearing. It is in the fifth pair that he supposes all these distinct and special endowments to reside. But the experimental proof will be found to be singularly inconclusive. The olfactory nerves were entirely destroyed in a dog. After the operation it continued sensible to strong odours, as of ammonia, acetic acid, or essential oil of

lavender; and the introduction of a probe into the nasal cavity excited the same motions and pain as in an unmutilated dog. The fifth pair was then divided in several young animals, the olfactory being left entire. All signs of the perception of strongly odorous substances, as sneezing, rubbing the nose, or turning away the head, entirely disappeared. From these facts, Magendie infers that the seat of the sensations of smell is in the fifth, and not in the first pair of nerves. It is obvious that Magendie has confounded two modes of sensation, which are essentially distinct in their nature and in their organic seat, viz. the true perceptions of smell, and the common sensibility of the nasal passages. The phenomena, which he observed to cease after the section of the fifth nerve, are the results of simple irritation of the pituitary membrane, and are manifestly wholly unconnected with the sense of smelling, since they are producible by all powerful chemical agents, even though *inodorous*, as, for example, by sulphuric acid. No proof has been given that the true olfactory perceptions do not survive the destruction of the fifth pair. Indeed, in a subsequent paper, Magendie confesses that the loss of sensibility in a nasal membrane, after section of the fifth, does not prove the residence of the sense of smell in the branches of that nerve; but merely that the olfactory nerve requires, for its perfect action, the co-operation of the fifth pair, and that it possesses only a special sensibility to odorous particles.

There is even less ground for supposing that the fifth pair is in any degree subservient to the senses of sight and hearing. After cutting this nerve on one side, the flame of a torch was suddenly brought near the eye, without inducing contraction of the pupil; but the direct light of the sun caused the animal to close its eyelids. Thus the sensibility of the retina, though somewhat impaired, was not destroyed by division of the fifth pair. But section of the optic nerves was immediately followed by total blindness. In another rabbit, Magendie divided the fifth pair on one side, and the optic nerve on the other. The animal, he states, was completely deprived of sight, though the eye, in which the fifth pair only had been cut, remained susceptible to the action of the solar rays. No evidence, however, is offered to show that the animal was entirely blind: on the contrary, the only change observed, on approaching a torch to an *uninjured* eye, was contraction of the iris; and this we are told was actually observed in the eye of the side on which the fifth nerve had been divided.

Magendie has assigned another singular function to the fifth pair, viz., to preside over the nutrition of the eye. Twenty-four hours after section of this nerve, incipient opacity of the cornea was observed, which gradually increased till the cornea became as white as alabaster. There was also great vascularity of the conjunctiva extending to the iris, with secretion of pus, and formation of false membranes in the anterior chamber. About the eighth day, the cornea began to detach itself from the sclerotica, the centre ulcerated, and the humours of the eye finally escaped, leaving only a

small tubercle in the orbit. In this experiment, the nerve had been divided in the temporal fossa, but when cut immediately after leaving the pons Varolii, the morbid changes were less marked, the movements of the globe of the eye were preserved, the inflammation was limited to the superior part of the eye, and the opacity occupied only a small segment of the circumference of the cornea. After division of the nerve near its origin in the medulla, no traces of disease were discoverable in the eye till the seventh day, and these symptoms never became very prominent. Several cases have been since recorded of structural disease of this nerve in the human subject, with the concomitant symptoms. That of Lainé, described by Serres in the 4th vol. of Magendie's *Journal*, furnishes strong support to the views of Magendie.[1]

A different explanation of this fact, and of others which have a tendency to refer secretion and nutrition to the control of the nervous system, has been proposed by Dr. Alison. Mucous surfaces are protected from the contact of air and foreign bodies by a copious secretion, which is evidently regulated in amount by their sensibility, since it is increased by any unusual irritation. This is especially true of the membrane of the eye. Now, section of the fifth pair is known to paralyse the sensibility of that organ, and the contact of air or other irritating body upon the *insensible* membrane, instead of inducing an augmented mucous discharge, will excite the inflammatory process described by Magendie. The disorder of the digestive function,[2] which followed division of the par vagum in the experiments of Dr. Wilson Philip, and the ulceration of the coats of the bladder after injury of the lower part of the spinal marrow, are attributed by Dr. Alison to the same cause.

The class of nerves which comprehends the fifth pair and the thirty-one pairs of spinal nerves, becomes, after the union of their roots, invested with a twofold endowment, and continues so throughout their entire course and final distribution to the muscular tissue. It would appear, indeed, from a later paper of Sir Charles Bell,[3] that nerves of sensation, as well as of motion, are necessary to the perfect action of the voluntary muscles. "Between the brain and the muscles there is a circle of nerves; one nerve conveys the influence from the brain to the muscle, another gives the sense of the condition of the muscle to the brain." In the case of the spinal nerves this circle of intercourse is at least probable; but proof of its necessity must be obtained, from observing the habitudes of those encephalic nerves, which minister exclusively to motion. Now it is found, on minute dissection, that the muscles of the eyeball, which are supplied by the third, fourth and sixth motive nerves, also receive sensitive filaments from the ophthalmic branch of the fifth; and that the muscles of the face, to which the portio dura is distributed, are also furnished with branches of sen-

[1] See also a case of destruction of the olfactory nerves, tom. v.
[2] Outlines of Physiology, p. 71.
[3] Philosophical Transactions, 1826, p. 163.

sation from the fifth. Sir Charles Bell has further shown that the muscles of the lower jaw, to which the motive impression is propagated by the muscular branch of the inferior maxillary, draw nervous supplies also from the ganglionic or sensitive branch of that division of the fifth pair. This complicated provision has its origin, he supposes, in its being "necessary to the governance of the muscular frame, that there should be consciousness of the state or degree of action of the muscles."

III. The olfactory, auditory and optic nerves are gifted with a special sensibility to the objects of the external senses, to which they respectively minister. Magendie seems to have been the first to prove, experimentally, that they do not also share the common or tractile sensibility. He exposed the olfactory nerves, and found that, like the hemispheres of the brain from which they spring, they are insensible to pressure, pricking, or even laceration. Strong ammonia was dropped upon them without eliciting any signs of feeling. The optic nerve, and its expansion on the retina, participate with the olfactory in this insensibility to stimulants. This was proved by Magendie in the human subject as well as in animals. In performing the operation of depressing the opaque lens, he repeatedly touched the retina in two different individuals without awakening the slightest sensation. The portio mollis, or acoustic nerve, was also touched, pressed, and even torn without causing pain.

IV. The functions of the ganglia, of the great sympathetic nerve, and its intricate plexuses and anastomotic connections, are matter, at present, of conjecture. Dr. Johnstone, in an essay on the Use of the Ganglions, published in 1771, has described a few inconclusive experiments on the cardiac nerves. He supposes that "ganglions are the instruments by which the motions of the heart and intestines are rendered uniformly involuntary,"—a notion which Sir Charles Bell has shown to be totally unsound. The best history of opinions, to which indeed our knowledge reduces itself, will be found in the physiological section of Lobstein's work, De Nervi Sympathetici Fabrica, Usu, et Morbis.[1]

In the earliest of his communications to the Royal Society, as well as in his last work on the Nervous System,[2] Sir Charles Bell has maintained the existence of a separate class of nerves, subservient to the regular and the associated actions of respiration. The origins of these nerves[3] "are in a line or series, and from a distinct column of the spinal marrow. Behind the corpus olivare, and anterior to that process, which descends from the cerebellum, called sometimes the corpus restiforme, a convex strip of medullary matter may be observed. From this tract of medullary matter, on the side of the medulla oblongata, arise, in succession from above

[1] Paris, 1823.
[2] 4to, 1830.
[3] The Nervous System of the Human Body, p. 129. 4to, 1830.

downwards, the portio dura of the seventh nerve, the glossopharyngeus nerve, the nerve of the par vagum, the nervus ad par vagum accessorius, and, as I imagine, the phrenic and the external respiratory nerves." The fourth pair is also received into the same class.

This doctrine of an exclusive system of respiratory nerves, associated in function by virtue of an anatomical relation of their roots, has not, as Sir Charles Bell seems himself aware,[1] received the concurrence of many intelligent physiologists of this country or of the continent. Mr. Herbert Mayo, in the admirable essay already referred to, was the first to point out the true relations of the fifth and seventh nerves. He has shown that the muscles of the face, excepting those already enumerated, which elevate the lower jaw, receive their motive nerves exclusively from the seventh, and consequently that this nerve must govern *all* their motions, voluntary as well as respiratory. But Dr. Alison, in his very elaborate paper[2] "On the Physiological Principle of Sympathy," has cast considerable doubts on the soundness of this part of Sir Charles Bell's arrangement, as respects not only the individual nerves thus classed together, but even the general principle on which the entire system rests. The reasoning of Dr. Alison consists, first, in referring the phenomena of natural and excited respiration to the comprehensive order of sympathetic actions. In these "the phenomenon observed is, that on an irritation or stimulus being applied to one part of the body, the voluntary muscles of another, and often distant part, are thrown into action." Now it has been long since fully established by Dr. Whytt, that these associations in function cannot be referred to any connections, either in *origin* on in course, of the nerves supplying remote organs so sympathising; and that a *sensation* is the necessary antecedent of the resulting muscular action. Thus it is known that these actions cease in the state of coma; are not excited when the mind is strongly impressed by any other sensation or thought; and that the same muscular contractions may be induced by the irritation of different parts of the body, provided the same sensation be excited. Dr. Alison has, however, failed to show[3] that the essential acts of inspiration, viz. the contractions of the diaphragm and intercostals, require the intervention of a sensation. Their continuance in the state of coma, as in the experiments of Legallois and Flourens after the entire removal of the brain, and their distinct reference by these two inquirers to the medulla oblongata, which has never been supposed to be the seat of sensation, prove them to be independent of the will and of perception. But this is true only of the essential, not of the associated respiratory phenomena.

[1] Op. cit., p. 115.

[2] Transactions of the Medico-chirurgical Society of Edinburgh, 1826, vol. ii. p. 165.

[3] P. 176 and note

Dr. Alison proceeds to show that there is equal reason for classing almost all nerves of the brain, and many more of the spinal nerves, with those exclusively named respiratory by Sir Charles Bell. Thus the lingual nerve governs an infinite number of motions strictly associated with respiration: the inferior maxillary "moves the muscles of the lower jaw in the action of sucking,—an action clearly instinctive when first performed by the infant, frequently repeated voluntarily during life, and always in connection with the act of respiration." Again, the sensitive branches of the fifth pair co-operate in the act of sneezing. But if these nerves be admitted into the system, the fundamental principle of that system, viz. origin in a line or series, is at once violated. Nor is this connection in origin more than matter of conjecture, as regards two of the most important of the nerves, classed by Sir Charles Bell himself as respiratory,—the phrenic and the external respiratory. These two nerves branch from the cervical or regular double-rooted series. Moreover, the circumstance of rising in linear succession is not found to associate nerves in function. "Between the roots of the phrenic nerve and those of the intercostals, there intervenes in the same series the origins of the three lowest cervical nerves, and the first dorsal, which go chiefly to the axillary plexus and to the arm, and which are not respiratory nerves."

In recapitulation, the following facts are among the most important that have been fully ascertained in the physiology of the nervous system.

1. One universal type has been followed in the formation of the nervous system in vertebrated animals. The brain of the human fœtus is gradually evolved in the successive months of uterine existence; and these stages of progressive developement strictly correspond with permanent states of the adult brain at inferior degrees of the animal scale.

2. These successive increments of cerebral matter are found to be accompanied by parallel advances in the manifestation of the higher instincts and of the mental faculties.

3. That the brain is the material organ of all intellectual states and operations, is proved by observation on comparative developement, as well as by experiments on living animals, and by the study of human pathology. But there does not exist any conclusive evidence for referring separate faculties, or moral affections, to distinct portions of brain.

4. Certain irregular movements are produced by injuries of the corpora striata, thalami optici, crura cerebelli, and semicircular canals of the internal ear.

5. The tubercula quadrigemina preside over the motions of the iris, and their integrity seems essential even to the functions of the retina. They are also, according to Flourens, the points at which irritation first begins to excite pain and muscular contractions.

6. The cerebellum appears to exercise some degree of control

over the instruments of locomotion; but the precise nature and amount of this influence cannot be distinctly defined.

7. The cerebrum, cerebellum and medulla oblongata possess the faculty of acting primordially, or spontaneously, without requiring foreign excitation. The spinal cord and the nerves are not endowed with spontaneity of action, and are therefore termed subordinate parts.

8. The medulla oblongata exercises the office of originating and regulating the motions essential to the act of respiration. By virtue of its continuity with the spinal marrow, it also participates in the functions of that division of nervous matter.

9. The function of the spinal cord is simply that of a *conductor* of motive impulses, from the brain to the nerves supplying the muscles, and of sensitive impressions from the surface of the body to the sensorium commune. These two vital offices reside in distinct portions of the spinal medulla,—the propagation of motion in its anterior columns, the transmission of sensations in its posterier columns. There is no necessary dependence of the motions of the heart, and the other involuntary muscles, on the spinal marrow.

10. The nerves are comprehended in the following classes:—I. Nerves simply of motion; II. Of motion and sensation; III. Of three of the senses; IV. The ganglionic system.

I. The nerves of motion are the third, fourth, sixth, portio dura of the seventh, and the ninth. It is not ascertained whether the glossopharyngeal and spinal accessory nerves belong to this or to the second class.

II. The function of ministering both to motion and sensation is possessed by the fifth pair of cerebral nerves, and by the spinal nerves, which agree precisely in anatomical composition. The par vagum, however, which is one of the irregular nerves, has also a twofold endowment.

III. This division comprises the first and second pairs, and the portio mollis of the seventh pair. These nerves are insensible to ordinary stimulants, and possess an exclusive sensibility to their respective objects,—viz. odorous matter, light, and aërial undulations.

IV. The system of the great sympathetic nerve, and its associated plexuses and ganglia.

SKETCH

OF

THE ORIGIN AND PROGRESS

OF

ASIATIC CHOLERA.

BY ROBERT J. GRAVES, M. D.[1]

While the art of navigation was in its infancy, and communication by land between distant countries unfrequent and insecure, the different races and families of mankind who dwell far asunder on the earth's surface, were necessarily unacquainted with the appearance of new, or the existence of remarkable diseases amongst each other, and consequently, that department of medical science which may with propriety be termed, the geography of diseases, remained uncultivated. Now, however, we approach a new era, when the means of intercourse between the most distant nations have been so facilitated by the aid of an improved system of navigation, a commerce almost universal, and the daily increasing efficiency of steam power, that we may indulge in the rational hope of seeing the sciences studied after a new method, which will embrace within the range of observation, not merely the phenomena occurring in a single district or country, but those which take place over the whole surface of the globe. Already have the enlightened efforts of our own university, and the genius of one of its professors, prompted the rulers of many kingdoms to join in an alliance destined to establish magnetic observatories in distant regions, so as to make the globe of the earth itself a subject of extended experiment; the philosophers of the new world have combined with those of the old to examine simultaneously meteorological phenomena, and already have the records preserved by observers at sea and land, revealed the hitherto mysterious course of storms, and enabled us to map out the extent and direction of the shocks of earthquakes. When we investigate the physical changes which occur on our planet, we are encouraged to repeat and multiply observations, in the hope of discovering general laws, whose application will enable

[1] Dublin Journal of Medical Science, Jan. 1840.

us to explain the past and predict the future. But the surface of the earth abounds with beings in whom the creative powers of life display an order of phenomena more complicated and refined than any thing existing in unorganised matter. But for this very reason, and on account of this superiority conferred on organised matter, through the agency of vitality, each being thus animated is governed by laws which seem incapable of extension even to other living creatures of the same species; and consequently we are led to expect an individuality, an insulation among animals, which will prevent them from exhibiting changes occurring simultaneously among great numbers, and capable of being traced to the operation of general laws. A closer examination, however, proves that animals and plants are subject to the operation of physical agencies, which act upon numbers of individuals at the same time, and thus give rise to great varieties of diseases. Such diseases should be made a special object of study; many of them are, as it were, fixed, stationary, and confined to certain countries and districts. Thus the goitres, the *tumidum sub Alpibus guttur*, has from the earliest times been endemic in the valley of the Rhone, and other parts of Switzerland; modern travellers have observed it in certain parts of South America, and in *Kemaon*, a subalpine department of Hindostan. Agues, typhus, yellow fever, elephantiasis, berri-berri, Guinea-worm, yaws, Egyptian ophthalmia, are chiefly confined to the inhabitants of certain districts, and with a host of other complaints, would afford ample materials for the geography of fixed diseases.

On the other hand, there are affections of men and animals which travel from nation to nation, and tribe to tribe; sometimes these moving epidemics progress with such rapidity, that they speedily migrate over the whole earth; at other times they creep along with a slow and stealthy step, but their journey is continued year after year, until they have travelled round the world. The Asiatic cholera affords an example of the latter class, having been twenty years in compassing the earth; while influenza, an example of the former, often traverses the same space in a few months. Thus, the epidemic influenza of 1830–32, existed in Australia, and was afterwards noticed in the northern hemisphere at Moscow, whence in eight months it extended to St. Petersburgh, Warsaw, Frankfort, Paris, London;[1] three months subsequently, it appeared in Italy, and shortly afterwards in Gibraltar. Now it is deserving of attention, that this influenza travelled from Moscow to London in eight months, and to the United States of America in seven months more, and allowing something for the inaccuracy of dates, these data give its rate across the Atlantic only a little speedier than across the continent. This forms, as we shall hereafter see, a striking contrast with the progress of cholera from Britain to Quebec, as compared with its march from Moscow to London, and is a fact of

[1] British and Foreign Medical Review, No. xiii. p. 105.

considerable weight in arguing whether cholera, like influenza, is propagated by atmospheric influences.

The influenza of 1833, travelled much more rapidly than that of 1832, for originating in the northeast, there was but a few days' interval between its appearance in Moscow, Odessa, Alexandria, and Paris!

Influenzas differ from each other, not merely as to their rate of travelling, but as to the extent of the earth's surface which they affect. Some, as that of 1782, spread from China all over the inhabited parts of Asia, Europe, and America; while others, as for instance the great influenza of 1837, did not reach the new world at all, although it passed the equinoctial line, and was severely felt at the Cape of Good Hope and Australia. These facts alone are sufficient to stimulate our curiosity, and ought to direct the attention of philosophers as well as physicians, to the study of endemic and epidemic diseases; nor will their study be destitute of practical benefit, for were the rulers of civilised nations to bring into active operation a number of institutions, which discharging the functions of *medical observatories*, should observe and record the appearance and symptoms of epidemics, many curious facts relating to their origin and progress would be soon brought to light, and we might then perhaps be enabled to arrive at a knowledge of some general laws respecting their motions. Thus we could ascertain whether, as has been asserted, influenza always progresses from east to west, never from west to east; whether originating on one side of the equator it often passes to the other. As the means of communication are now-a-days so rapid, it is quite possible to learn the character, and the best mode of treating an epidemic disease long before its arrival amongst ourselves; we knew, for instance, the symptoms and best method of treating the influenza of 1837, several weeks before we experienced its shock, and we had for many years been familiar with the symptoms of cholera before we actually witnessed its baneful effects. I have still by me a manuscript copy of a lecture I gave at the Meath Hospital in 1826; in that lecture I accurately described, from eastern authors, the symptoms of spasmodic cholera, and prepared the class for its future arrival in Great Britain,—a prediction not my own, but derived from that illustrious philosopher, and truly excellent man, Dr. Brinkley, then President of the Royal Irish Academy.

The origin and march of the spasmodic cholera will form the subject of the remarks which I now mean to lay before this meeting. In India, or more properly speaking, in Hindostan, the spasmodic cholera is not a new disease; partial epidemics of it have occurred at different times since that empire has been familiarly known to the English. These epidemics, however, being almost exclusively confined to the natives, comparatively circumscribed in extent, and limited in duration, did not attract much attention on the part of European writers.

"In 1762 it prevailed very extensively in upper Hindostan,

destroying, according to Le Begue de Presle, thirty thousand negroes, and eight hundred Europeans. Dr. Paisley, in a letter from Madras in 1774, states that it was often epidemic, especially among the blacks. M. Sonnerat, in the account of his travels in India between the years 1774 and 1781, mentions that cholera prevailed on the Coromandel coast, and at one period more particularly, assumed an epidemic and malignant character. Curtis, in his work on the diseases of India, and Girdleston, in his essay on the Spasmodic Affections of that country, speak of an unusual prevalence of the disease during 1781 and 1782. It prevailed in the northern Circars in the early part of 1781, and in the latter end of March it affected at Gangam, a division of Bengal troops, consisting of five thousand men, who were proceeding under the command of Colonel Pearse, of the artillery, to join Sir Eyre Coote's army on the coast. Men, previously in perfect health, dropped down by dozens, and those even less severely affected, were generally dead, or past recovery, within less than an hour. Above five hundred were admitted into the hospital in one day, and in three days, more than half the army were affected.

"In April, 1783, it broke out at Hurdwar, on the Ganges, a spot held peculiarly sacred by the Hindoos, among a crowd of between one and two millions of persons, assembled for the purpose of ablution in the holy stream. It is the custom of the pilgrims to repair to the bed of the river, where they pass the night with little, if any shelter. Very soon after the commencement of the ceremonies, the cholera attacked the pilgrims, and in less than eight days, is supposed to have cut off twenty thousand of them. The disease was, however, on this occasion so confined in its influence, as not to reach the village of Jawalpore, only seven miles distant."[1]

In Europe no such disease as spasmodic cholera had been known; this assertion, though opposed to some authorities, may be considered as well founded, and indeed I have no doubt of its accuracy. With us spasmodic cholera is an imported disease; in Hindostan a resident endemic. What causes combined to convert a malady habitually confined to the Indian peninsula, into a disease which overshadowed the earth, sparing no nation or language, it would be useless to inquire; the subject is buried in profound obscurity: in the mean time let us hope that it will not prove a permanent addition to the nosology of every country, and that it will soon return within its former limits. It was in the spring of 1817, that the cholera of India assumed a new and more powerful character: it was then it became endowed with properties that rendered its extension steadily progressive over the earth, in spite of all the obstacles interposed by diversity of soil or climate. The disease first assumed the migratory and epidemic form in districts bordering on the Ganges, and some of its tributary rivers, at a distance varying from 80 to 150 miles from Calcutta. This took

[1] American Cholera Gazette, p. 3.

place in the spring and summer, but the date of its commencement is usually referred to the period of its outbreak at Jessore, on the 19th of August, 1817, where the epidemic was first medically observed and described by Dr. Tytler, who erroneously attributed it to the use of bad rice. Jessore is situated in the Gangetic Delta, about one hundred miles northeast of Calcutta. The cholera was now observed in general to follow the course of the rivers, and soon arrived at Calcutta, where it commenced its ravages in September, 1817, and continued to rage during nearly the whole of 1818.

"By the latter end of September, the disease was prevailing throughout the whole province of Bengal, from the most easterly limits of Purnea, Dinagepore and Silhet, to the extreme borders of Balasore and Cuttack; and from the mouth of the Ganges nearly to the confluence of that river with the Juhmna, a space of upwards of four hundred miles in length and breadth. In this area of several thousand miles, few places escaped the invasion, and the cities of Dacca and Patna, the towns of Balasore, Burrissaul, Rungpore, and Malda suffered severely. The large and populous city of Mooshedabad, which, from extent and local position, was apparently favourably circumstanced for the attacks of the epidemic, it is remarkable, escaped with comparatively little loss, whilst all around was severely scourged.

"During the autumn of 1817, the disease extended itself to Muzufferpore and beyond the precincts of Bengal, and appeared at Chuprah, and at the cantonment of Gazeepore; its attacks in these places were, however, confined to the towns themselves, or villages in their immediate vicinity; the principal portion of the adjoining country at this period, entirely escaping the disease. Early in November it attacked the grand army, then stationed at Bundlecund, a portion of the Allahabad province. This army had been assembled in anticipation of a war with the Pindarees, and the centre division, consisting of ten thousand fighting men, and eighty thousand camp followers, was encamped on the banks of the Sinde, under the immediate command of the Marquis of Hastings. Here the cholera exercised its most destructive power. It is uncertain whether it made its first approaches on the 6th, 7th, or 8th of the month. After creeping about, however, in its wonted insidious manner for several days among the camp followers, it seemed all at once to have gained vigour, and burst forth with irresistible violence in every direction, extending through the whole camp before the 14th of the month. Old and young, European and native, fighting men and camp followers, were alike subject to its attacks, and all equally sunk in a few hours under its pestilential influence. It was a common occurrence for sentries to be suddenly seized at their posts, and having been carried in, to have two or three successors before the two hours' duty was performed. Many of the sick died before reaching the hospitals; and even their comrades, whilst bearing them from out-posts to medical aid, sunk themselves

suddenly seized with the disorder. The mortality at length became so great that there was neither time nor hands to carry off the bodies, which were thrown into the neighbouring ravines, or hastily committed to the earth on the spots where they expired, and even round the walls of the officers' tents. In the five days, included between the 15th and 20th of November, the number of deaths amounted to five thousand. The natives thinking their only safety lay in flight, deserted in great numbers; and the highways and fields for many miles round were strewed with the bodies of those who had left the camp with the disease upon them, and speedily sank under its exhausting influence. The camp being now cumbered with the sick, the Marquis of Hastings determined to seek a purer air for the recovery of his sick. Although every means was put in requisition for their removal, a part was necessarily left behind. 'And as many who left the carts, pressed by the sudden calls of the disease, were unable to rise again, and hundreds dropped down during every subsequent day's advance, and covered the roads with dead and dying, the ground of encampment, and line of march, presented the appearance of a field of battle, and of the track of an army retreating under every circumstance of discomfiture and distress.'[1] The exact mortality could not be ascertained, but it appears that of the fighting men seven hundred and sixty-four fell victims, and it was estimated that about eight thousand camp followers, or one tenth of the whole, were cut off. On arriving at the high and dry banks of the Betwah, at Erich, the army soon got rid of the pestilence and met with returning health.

"During December the disease appears to have every where abated, and in January of 1818, to have become nearly extinct. Towards the latter end of February it however revived with great force, and before the close of the year, the whole peninsula of India, from Silhet on the east to Bombay on the west, and from Deyrah on the north to Cape Comorin on the south, had suffered from its ravages."[2]

The ravages of the disease were much facilitated and increased by the superstition of the people, who, in obedience to the Brahmins, collected in prodigious multitudes on pilgrimages to certain favourite shrines, where they prayed for the cessation of what they were taught to believe the cause of the epidemic, viz. a violent and protracted battle between the god and goddess answerable for the tranquillity and happiness of that part of the world.

During the year 1818 the cholera pursued a threefold route. First, ascending the Ganges and the Juhmna, it reached the northern provinces of Hindostan, but was there checked in its progress for several years by the Nepaulese mountains, and finally entirely arrested by the Himalaya range. This is easily accounted for by the thinness of the population in these situations, and the little intercourse which takes place between the mountainous dis-

[1] Bengal Report, pp. 12-15. [2] American Cholera Gazette, p. 19.

tricts and the lower regions. Cholera did not in India attain to an elevation beyond six thousand feet above the level of the sea; in June, 1818, it had reached the range of mountains between Nepaul and Hindostan; it was at *Schaurapoor*, many hundred miles to the northwest, in October; and before the end of the year had ravaged nearly all the numerous cities and villages situated in the vast tract of country watered by the Ganges, the Juhmna, and their tributaries. This was one of the most thickly inhabited parts of India, and the destruction of life was awful.

The second route was southward along the coast from one seaport to another, until it reached Madras on the 24th of October, 1818. Here, at the very onset of the disease, twenty medical men were attacked, of whom thirteen died.

Sadras, Pondicherry, and the whole Carnatic, were affected during the succeeding year; but even in December, 1818, it had reached Jaffnapatam, the most northern town of Ceylon, having passed thither after travelling along the whole coast of Coromandel. On the 10th of January, 1819, it broke out in Colombo, and produced dreadful devastation on the western coast of Ceylon; the disease became exhausted there, but at the same moment burst forth with renewed vigour in Candi, the capital, 2500 feet above the level of the sea. The cholera did not arrive at the east coast of Ceylon until 1820, when it appeared imported, as was said, into Trinkamalay by the flag-ship Leander. The epidemic was brought to the western coast of the Indian peninsula, partly by sea round Cape Comorin, and partly by the great over-land lines of communication which connect the presidency of Bombay with the presidencies of Madras and Bengal.

It first showed itself at Bombay on the 9th of August, 1820, and in that presidency carried off 150,000 persons.

The third route of cholera in India I have already referred to, it was across the peninsula from the east coast to the west; it came by Nagpoor, Ellishpoor, Aurungabad, Siroor, and Poonah, to the Bombay coast, and was introduced either by troops or travellers.

From Ceylon the disease went to the Mauritius, and the Isle of France; whither it was said to have been imported on the 29th of October, 1819. The distance thus traversed at one spring was three thousand miles. Thence it soon passed to the Isle of Bourbon; and in the year 1820 to the east coast of Africa at Zanguebar. It is remarkable that it never reached the Cape of Good Hope, where the strictest quarantine was observed.

The following are the dates of its arrival in the subjoined places:—

Burmese empire generally; Aracan, Ava, 1819.
Malacca, 1818.
Sumatra, 1819.
Java, Batavia, (fearful,) 1821.
Madura; Macassar; after Batavia.
Amboina, in Moluccas, 1823.

Amboina was the farthest south-easterly point it attained to.

The disease visited Borneo and Celebes; and in 1820 broke out with extraordinary violence in the Philippine Islands, principally at Manilla, where the natives, misled by the idea that they were the victims of poison administered by the Europeans and Chinese, rose *en masse*, and were not put down until 15,000 lives had been sacrificed in the contest. Similar manifestations of feeling led to some loss of life even in Petersburgh and Paris, when cholera reached those cities. The same suspicions agitated the inhabitants of Europe during the ravages of the black death in the fourteenth century, when the Jews were slain in great numbers as authors of the plague. In Great Britain I am not aware that any such insane popular ideas were manifested when cholera appeared. In Ireland nothing of the sort was displayed; and barbarous, cruel, and uneducated, as we are said to be, the visitation was in no country met with greater intrepidity and resignation, than in our native land. When a city or town was attacked in Ireland, we never witnessed the flight of the better classes; there was neither migration into the country, nor desertion of their poorer fellow-citizens. No; I record the fact with pride, every one remained, every one was ready to do his duty and abide in his place until the plague was stayed. In Dublin, and generally throughout Ireland, the members of the medical profession, and the public at large, believed the malady to be contagious, and yet the sick were never abandoned by their friends in private houses, nor in the least neglected in the hospitals.

In 1819 the cholera appeared in Siam, Bankok, Tonkin, Cochinchina, and caused immense loss of life in Cambodia. In 1820 it arrived at Macao, and was said to have been imported by some ships; thence it travelled to Canton in China, and coming to Nanking in 1820, penetrated as far as Peking in 1821. In China the disease proved particularly fatal on account of the denseness of the population of the Celestial Empire.

So far we have followed the cholera chiefly southward and eastward in the first instance, but afterwards far to the north; in this part of its course it passed 10° to the south of the line, and then resuming a northerly direction, went on to Peking, in latitude 40° north. Even this portion of its progress leads forcibly to the conclusion, that it followed the track of commerce, whether by land or sea, and was not dependent for propagation on mere local influences, or climate. *There is a popular idea current, that its course was westward; such was the case in Europe, but in most of Asia it was eastward.*

I have already said that the Himalaya range opposed the progress of the disease northward from Hindostan, and that the highest altitude it attained to was six thousand feet. With respect to this latter point, I learn from my friend Captain Meredith of the 13th regiment, and who has just returned from India, that it broke out in the medical depot at Landour in 1838, for the first time, at a

height of eight thousand feet above the level of the sea. It is worthy of remark that cholera did not come to New Holland, although it was in several islands, as Borneo, and Celebes, to the north of Australia; but it is to be noted that there is little or no communication between them and the settled portions of New Holland.

Let us now trace its progress westward from Hindostan. The general belief in Persia is, that the disease was brought in ships from Bombay to Mascate, Bender-abassi and Bassorah, in which places it appeared nearly at the same period, in spring, 1821.

From Bassorah and Bender-abassi, the epidemic spread in a well-defined and marked manner, along the rivers and routes most frequented by commercial travellers.

Thus from Bassorah it crept up the Euphrates and Tigris; and in August, 1821, was at Bagdad, where it carried off great numbers of the Persian army then besieging that city. Along the Euphrates it proceeded to the ruins of Babylon, and by the great route of the caravans across the desert, it arrived at Aleppo. Here it did not commit great ravages, and ceased in the following December; but afterwards extended to different towns in Asia Minor, as Mosul, Merdin, Darbeker. At Alexandretta, situated on the Gulf of Scanderoon, it did not arrive until 1823. It is strange that cholera did not continue very long in Asia Minor or Syria, and did not at that period penetrate into Egypt.

From Bender-abassi in Persia, cholera travelled along the great mercantile road to Shiras in August, 1821; and thence to Yezd, where it appeared towards the end of September, but on the approach of winter lay dormant until spring, 1822, when it again showed itself, and spread north-westward, committing the greatest ravages in every town and village situated on the great caravan road. Tauris, Korbia, Ardabil, and the provinces of Kalkhai, Masinderan, and Gilan, (on the Caspian,) were soon infected. In most of these places it seemed to cease for a time, but reappeared in the middle of 1823; and travelling along the Persian seaports of the Caspian, it reached the province of Shirwan, then lately ceded to Russia. Here it ascended the river Cur, and progressed along the high roads to the fortress Baku; and on the 21st September, 1823, Astrachan was attacked. In June, 1823, cholera showed itself in the neighbourhood of Laodicea and Antioch, (modern names,) and then spread in two directions along the coast of the Mediterranean, but disappeared again both there and on the coast of the Caspian Sea.

On the whole, then, the epidemic, from its commencement in 1817 till the end of 1823, had travelled over ninety degrees of longitude, and sixty-six degrees of latitude, viz. from the Philippine Islands to the coast of Asia Minor, and from the island of Bourbon to Astrachan, and to the Caspian Sea.

It is very remarkable that cholera did not come to Europe by way of Asia Minor; this circumstance may perhaps be explained

by the accident of its not having infected Smyrna, the chief seaport of communication between Asia Minor and Europe. Had Egypt likewise been then attacked by cholera, it is doubtful whether Europe would have been so long spared. Be this as it may, from the end of 1823, until its out-break at Orenburgh in 1829, cholera seemed to halt on the very confines of Europe, so that we may consider the years from 1817 to 1823 as constituting the first period in the progress of this epidemic.

But although the cholera ceased to attract much attention in Europe during the interval which elapsed between 1823 and 1829, yet we are not on that account to conclude that it lay entirely dormant, for we find it continued its ravages in its original seat, India, and extended itself from Asia Minor, Persia, and China, through the vast regions of Tartary and Chinese Tartary.

The thinness of the population in these half desert regions, may be the reason why the progress of the disease through them was at once so uncertain and so slow; the want of frequent communication between even neighbouring districts, may have baffled for a time the march of the pestilence, and may have occasioned its remarkably slow progress towards the Russian frontier. Certain it is that this march in Persia, Tartary, Mongolia, and Thibet, countries absolutely destitute of regular roads, formed a striking contrast with its rapid transmission through more populous and highly cultivated countries, or its still quicker passage from one maritime nation to another, when connected by a constant trade, as from Germany to England, from England to Canada, and from the East Indies to the Isle of France. In the latter cases the epidemic sprung from one country to another; *but it is remarkable that it never traversed the ocean at a rate exceeding that of ships.*

We next come to the second period of the history of cholera, when it broke out at Orenburgh, in August, 1829, where it raged with great violence, spreading throughout the whole of that Russian province; while the disease, after long lingering in the north of Persia, assumed, in 1829, an increased energy in that kingdom, from whose northern portions it spread along the western coast of the Caspian, arriving at Salian, and the province Shirwan in June, 1830; and thus spreading to Baku, Kuba, and Sheki, in Chomath Talisch, and in the district Elizabethpol. From this the epidemic pursued a twofold route; the one following the Kura, upwards, led to Tiflis, where the mortality reached five thousand; and thence to the provinces between the Black Sea and the Caspian, until it a second time came to Astrachan, and proved much more fatal in that city than in 1823, now counting more than eight thousand victims.

From Astrachan the progress of the cholera up the Wolga or Volga was very remarkable, as it spread from town to town on that river, in the direct route of intercourse and traffic. I here may remark, that whenever cholera travels up the highest mountain passes, as in India, or traverses the ocean, as to the Isle of Bourbon,

or accompanies the caravan across the desert, as when it arrived at Mecca and Medina, or when it ascends rivers, making the towns on its banks the successive stages of its journey; in all such cases, cholera, I say, seems regulated by no common physical circumstances, except human traffic and human intercourse; for in other things these lines or routes differ remarkably from each other. But to follow its ascent of the Volga: in 1830, in August, it came to Saratow, and shortly after to Kasan, Nischnei Nivogrood, Kostroma, Jarislaw, and so on to the circle Tischwin, in the government Nowgorod, where it was only 250 versts distant from Petersburgh, and where it attained for that year to its highest northern limit.

From the country between the Caspian and Black Sea, it spread through the Caucasus to the Don, which it ascended, while it coasted the Black Sea to Cherson and Odessa, in September and October, 1830.

The stream of cholera which entered Russia from the northern provinces of Persia, as it may be seen from the foregoing account, soon formed a junction with that which flowed from Tartary through Orenburgh.

In the middle of September, 1830, the disease appeared in the government of Moscow; and on the 20th of September in the capital itself, and did not cease until the end of the following March. In Moscow a severe frost and snow set in towards the end of November, without in the least diminishing the diffusion or the intensity of cholera. Its unabated continuance throughout the whole of a Moscow winter, is a fact worthy of attention; in Moscow, according to Jahnichen, there sickened between thirty and forty per cent. of the persons who had hospital duty to perform, including physicians, nurses, &c., while of the whole population not more than three per cent. took the disease. In Dublin likewise great numbers of the hospital attendants were affected and many died; still more were saved by the timely exhibition of remedies. It is not quite correct to affirm that cholera ceased in Moscow in March, for in the autumn of 1831 more than one thousand cases occurred.

During the winter and spring, 1830–31, cholera spread far to the west and south, viz. to Kaluza, Talu, Pultawa, Kiew, Podolia, Bessarabia, Bulgaria, and Silistria, and through the river provinces of the Dnieper, the Bug, and the Dniester.

In the more northerly and eastern governments, the disease had ceased, while it continued, though in a milder form, in the provinces Nicolajaw, Crakow, Tauris, and among the Cossacks of the Black Sea. Petersburgh a second time remained untouched, although the disease had arrived at Tishwin, within one hundred miles of it, an immunity to be attributed to the strict precautionary measures adopted, and the *cordon sanitaire* drawn around the capital for the protection of its inhabitants, but not of its emperor, Nicholas, who, it is but just to add, had gone to Moscow the moment he had ascertained the existence of cholera in that city, in

order to exert himself in alleviating the sufferings of his subjects. The fear of infection proved no obstacle to the Czar, who zealously performed his duty on that trying occasion. The following facts relative to Russia are taken from Dr. Simpson's *brochure*.

"*Pensa.*—From the accounts of the progress of the cholera in Russia, where the disease was so accurately observed, we shall subjoin only two cases, the first of them containing the history of the introduction of the malady into a village, in the government of Pensa, as detailed by Sir William Russell, (on what he considers to be sufficiently credible authority,) in one of his letters from St. Petersburgh:—[See Edinburgh Medical and Surgical Journal for February 1832, Supplemental Number, pages 173-4.] The son of an inhabitant of the village, who was coachman to a nobleman, at fifty versts distance, died of cholera. The father went to the place to collect the effects of the son, and brought home with him his clothes, which he put on and wore for a day or two after his arrival in his native village. He was shortly after seized with cholera and died of it. Three women who had watched him in sickness, and washed his body after death, were also seized, and died of the disease. The common street of the village was then barricaded on that side which the disease had not reached, and all intercourse interdicted with the infected side. In that side of the village where the disease first broke out, upwards of 100 cases of cholera occurred, and of these 45 died, while on the other side which had been barricaded, no case was observed."

"*Iletsk.*—We select the following case from the official Russian reports, as affording a remarkable instance of the transportation of cholera by exposed and infected individuals over a wide tract of country to a distant locality, while all the intervening district remained for the time totally unaffected. In the fortress of Iletsk, in the government of Orenburgh, the first cases of cholera, which were observed on the 2d of October, occurred in a soldier and a woman, who were taken ill of the disease while returning together from the city of Orenburgh, (forty-two miles distant,) in which the cholera was at that time raging. The intermediate line of country between Orenburgh and Iletsk was still unaffected. The soldier and woman, before leaving Orenburgh, had been in company with a man affected with cholera, and they both died of the disease on the day after their arrival at Iletsk. The malady soon spread to other persons in the garrison, and Dr. Schimanski, the staff-physician, traced out very distinctly the progress of the disease, throughout the first eight cases. The two first victims, the woman and soldier, contracted, as I have just stated, the disease in Orenburgh. The husband of the woman was seized three days after her; about the same time two girls, who lived in the immediate neighbourhood of her male travelling companion and fellow victim, and who had visited him soon after his arrival at Iletsk, were attacked. The aunt of these two girls, who nursed them, next suffered; and from her it spread to her two sons. The disease subsequently became diffused with

such rapidity, that in the course of twenty days 113 persons had been attacked."—[Edinburgh Medical Journal, l. c. p. 49.]

"In the official medical report upon the cholera, in the government of Orenburgh, which mentions the above case of Iletsk, it is stated, that in the same province alone *eight* similar instances had been ascertained judicially, and by physicians who were attending the course of the epidemic, in all of which a person, who had contracted a tendency to the disease, in a place where it prevailed, arrived in an uninfected locality, and there sickened, and communicated a morbific condition to the atmosphere of his new residence."

"*St. Petersburgh.*—When the cholera invaded St. Petersburgh in 1831, the city prison, containing about 400 inmates, remained perfectly free of the disease until the 23d of June, O. S. when a prisoner who had been sent out some weeks before to a public hospital to be treated for a syphilitic complaint, was returned back to the jail *with a diarrhœa upon her.* She saw and embraced her husband for a moment as she passed to the room of observation. In a few hours her symptoms became those of true cholera, and she died that night, forming the first case of the disease in the prison. The next persons attacked in the prison were three women placed in the same room with the first, and one of whom had rubbed the deceased. These three all died within three days after the first. The husband of No 1 became next affected. He lived in a separate part of the jail. After this man, others in his room took the disease; and it extended itself ultimately to 27 of the inmates of the prison, in all, 15 of whom died; and Drs. Russell and Barry, who have reported the case on the authority of Dr. Bish, the resident physician, state that there was but one out of these 27, to whom contagion could not at the time be traced. None of the noble class, who were lodged in a separate part of the building, were attacked.—See Edinburgh Journal for February, 1832, p. 175."

The war in Poland accelerated the invasion of cholera into that unhappy country, into which the Russian army commenced its march on the 5th of February, 1831, in three columns, of which many battalions came from infected provinces. Thus the governments of Volhynia, Grodno, and Wilna, were extensively under the influence of disease in the spring of 1831; during this campaign the Russian army lost great numbers by cholera, and Marshal Diebitch himself died at Pultusk, on the 10th of June, 1831, of a few hours' illness, a circumstance which gave rise to the unfounded rumour that he was poisoned; the details of his illness have been published by an eye-witness, Dr. Koch, of the Prussian service. In Warsaw, the disease appeared on the 14th of April, after the battle of Iganie, where the Poles took many prisoners, who were brought to Warsaw. In Poland the disease advanced and retreated with the infected armies in a striking and remarkable manner. Westwards and southwards from Warsaw, it spread rather slowly

towards the Prussian confines, arriving on the 23d July at Kozieglow, a little town nine miles south of Czenstochowa, and but two German miles from the frontier of Silesia.

Northwards the disease had spread in March and April through Lithuania to the seaports of the Baltic, particularly Riga. From Riga the cholera advanced through Courland and Liefland (Livonia).

Petersburgh was now threatened on every side, for the disease broke out with renewed violence in the European provinces formerly affected, while most of those which had hitherto escaped suffered in their turn. Under these circumstances the metropolis, considering the great quantity of goods and passengers who arrive by water carriage from the interior of the country, could not be expected to remain long exempted, although all possible precautions, short of entirely preventing communication with the country, were adopted; accordingly cholera appeared in Petersburgh in July, 1831. Very serious disturbances arose in the Russian metropolis among the lower orders, who considered the pestilence as artificially produced for their destruction by secret friends of struggling Poland. These troubles were only appeased by the presence of the emperor, but not before the mob had destroyed the cholera hospital, and murdered one of the physicians. During this epidemic seventeen medical men died in Petersburgh, and a great many others were attacked, some slightly, some severely. The hospital nurses, porters, and attendants, suffered in a very large proportion, as did a great number of the mob engaged in sacking the cholera hospitals. Cholera had already invaded several of the most northern provinces of Russia, and had arrived at Archangel in May, 1831. Archangel is the most northern emporium of commerce in the world, and is the highest latitude attained to by cholera, which in a population of 19,000 destroyed more than 1200. In the beginning of August cholera arrived at Helsingfor; and of September, at Abo in Finland. After this Aland and the neighbouring islands were affected, and so it passed into Sweden. Danzig, 30th May, 1831; Elbing, 11th July; consequently eleven weeks after its appearance in Danzig; but there was an interruption, or rather a great diminution of the intercourse between these towns. From Danzig the disease radiated in every direction throughout the neighbouring provinces. Thorn, 21st July, 1831; Konitz, 22d August; Memel, 27th July; Königsburgh, 22d July. Here a formidable cholera insurrection took place. Stettin, 25th August, 1831; Berlin, 30th August; Frankfort on Oder, end of September; Magdeburgh, 3d October.

From Magdeburgh the disease spread extensively upwards, along the course of the Elbe. Halle, 20th December, 1831; Merseburg, 1st January, 1832; Breslau, 23d September, 1831. In the first months of 1832, cholera had nearly disappeared from the German provinces of Prussia. Deaths 31,000. Hamburgh, 7th

October, 1831. Mecklenburg-Schwerin took most extraordinary precautions, and escaped.

Saxony, though Prussia and Austria on either side of it were severely visited, adopted strict measures of precaution, and escaped; the cholera was neither at Leipzig nor Dresden! Hanover also escaped, with the exception of Lüneburg, 22d October, 1831. Sachsen-Weimar, Gotha, Anhalt, Hessia, Brunswick, and some other small principalities, all escaped, and apparently by the same means, viz. non-intercourse with infected places.

In some Saxon villages, as Cosing and Edderitz, the disease broke out but did not spread, apparently in consequence of the measures of precaution instantly put in force by the authorities.

Austria suffered most severely; Brody, (Gallicia), 5th May, 1831; Limberg, 22d May; all over Gallicia in 1831. Died 97,770.

Cracow seems to have been infected, not from Poland, but from Gallicia.

Beginning of July, 1831, cholera began in Hungary. In beginning of June, 1831, much popular violence. Spread very rapidly. Pesth, middle of July; Presburg, 9th September, 1831.

In Hungary cholera had ceased as an epidemic by the beginning of April, 1832, having proved fatal to at least 240,000 persons! Vienna, 15th August, 1831; Prague, 28th November, 1831.

Bohemia was widely affected; but the disease did not spread from Vienna far either to the south or west, and accordingly Carinthia, Stiermark, and the Tyrol escaped, all being protected by the strictest precautionary measures.

It is worthy of being noted, that cholera remained, as it were, stationary and in a suppressed form during the winter of 1831–32, in Hungary, Bohemia, and Germany. It did not spread into Saxony, Mecklenburg, Bavaria, and scarcely into Hanover, although these bordered on infected states, an immunity not to be accounted for by the existence of any natural boundaries, as mountains or rivers, for the limits are mostly conventional between the infected principalities and those which escaped; many have therefore attributed their escape to the precautionary measures taken. It is strange that Leipsig was spared, while Halle suffered so long and so severely; the situation of the former city appearing to be much more favourable to the developement of *miasma* than that of the latter.

Moldavia, spring, 1831. In Jassy the deaths exceeded 6000, out of a population of 27,000. The disease began in June; and no doubt its diffusion was favoured by the unhealthy position of the town, and the condensation of a wretched population, chiefly Jews and Gipsies, in its filthy narrow streets. All the medical men, except three, perished, with most of their families. Bucharest, July, 1831; Bulgaria, July, 1831; Constantinople, July, 1831; Adrianople, Gallipoli, Philippopili, Sept. 1831.

It is to be noted that plague broke out in Constantinople at

the same time with cholera; but while the latter epidemic ceased towards the end of September, the former continued for several months longer. Cholera now a second time invaded Asia Minor, and simultaneously with plague caused great devastations. Corfu, October, 1831; Monastori, in Greece, November, 1831.

The destruction of religious pilgrims at Mecca was appalling. The place resembled a field of battle, so great were the numbers of the unburied dead; and at last even the fanaticism of Mussulmen was forced to yield, and the survivors sought safety in a hasty and tumultuous flight. Three fourths of the pilgrims are calculated to have perished during the three days they were densely crowded together at Mecca; and of the fugitives 10,000 fell victims on their journey. The Pasha of Egypt now repeated the precautions so successful in 1823, but this time they were taken in vain, because, as is supposed by many, they were not resorted to sufficiently soon; be this as it may, cholera broke out first at the two quarantine stations, where the pilgrims from Arabia were detained; and in the middle of August, 1831, it appeared in Cairo and Damietta, and towards the end of the month in Alexandria. Egypt lost on the whole 150,000. The cholera ascended the Nile, and was at Luxor, the site of ancient Thebes, by the end of September.

We next find the cholera visiting England, it arriving about the 4th of November at Sunderland, a seaport directly opposite to, and commercially connected with Hamburgh. The cholera spread to many towns in the north of England, but did not any where rage with very destructive violence, a circumstance attributable perhaps to the more complete separation of families in Great Britain, as compared with our continental neighbours. The existence of the disease was announced on the 27th of January, 1832, in Edinburgh, and on the 10th of February in London.[1] The ravages of the cholera in the metropolis were comparatively insignificant, its victims during the whole epidemic not exceeding 1500.

The following very interesting facts connected with the progress of cholera in Scotland, are taken from a highly important *brochure* by my friend, Dr. James Y. Simpson, of Edinburgh, on the Evidence of the occasional contagious Nature of Cholera.

"*Edinburgh.*—Before cholera reached Edinburgh, it raged for some time previously in a severe degree in the district of country lying to the east of the city, as in Haddington, Tranent, Prestonpans, &c., and particularly in the town of Musselburgh, six miles distant. The first cases of the disease which were observed in Edinburgh occurred towards the latter end of January, 1832, and were all in the persons of individuals who had been visiting some of the places to the eastward where the cholera was prevailing, and who had consequently been directly exposed to the morbific cause

[1] The progress of cholera in Great Britain will be found accurately traced in the annexed map.

or causes of the malady (whatever we allow these to be) which were operating in these infected localities. The second case (27th January) afforded an instructive example of the great difficulty which is often experienced in endeavouring to arrive at the truth in such investigations as the present. The subject of the case, an Irish woman, residing in a close off the West Bow, was taken to one of the cholera hospitals, and was for some time conceived to afford the strongest possible evidence against the doctrine of contagion, for she stoutly denied having been out of Edinburgh. During the period of her convalescence, however, she voluntarily mentioned to Dr. Ransford, then clerk to the hospital, that she had been some days previously singing in the streets of Haddington, Tranent, and Musselburgh, and had slept in Prestonpans in the bed of a cholera patient; and she stated that she had been before deterred from making this confession, under the dread that she would be punished for bringing the disease into the town.

"None of the three first cases of importation of cholera into the city proved effectual in propagating it to any of the resident inhabitants; and no instance of a person being attacked with the malady, who had not been in the infected eastern districts, occurred until Saturday, the 28th of January, when a woman, widow Mac Millan, died of it in Skinner's Close, High-street, after nursing her grandson, who was previously ill of the disease, and had been exposed to its contagion by residing in a house in Musselburgh, in which several fatal cases took place. Professor Alison has been so kind as to draw up for me the history of these two cases, in as far as they bear upon the question of imported contagion; and I shall here give the communication with which he has favoured me in his own words, and with his own excellent prefatory remarks and comments.

"'It seems to me clear,' he observes, 'that the evidence of the contagious nature of any disease turns ultimately on a calculation of chances. The question always comes to this,—Is the circumstance of intercourse with the sick followed by the appearance of the disease, in a proportion of cases so much greater than any other circumstance common to any portion of the inhabitants of the place under observation, as to make it inconceivable that the succession of cases occurring in persons having that intercourse should have been the result of chance. If so, the inference is unavoidable, that that intercourse must have acted as a cause of the disease. All observations which do not bear strictly on that point are irrelevant, and in the case of an epidemic *first* appearing in a town or district, a succession of two cases is sometimes sufficient to furnish evidence, which, on the principle I have stated, is nearly irresistible.

"'For example, in the case of Widow Mac Millan, in Skinner's Close, it is certain, as the whole town was under medical serveillance at the time, and every one on the watch for cases of even suspicious cholera, that she was the *first* person in Edinburgh or Leith (i. e. in about 160,000 people) who took the disease without

having been in the district of Musselburgh, Tranent, &c., where it prevailed; nor was there any case in Edinburgh or Leith, in a person who had not left the town for ten days after. And in regard to this first case of the disease in Mrs. Mac Millan originating in Edinburgh, the following points were ascertained by a judicial inquiry or precognition made, at the request of the board of health, by the sheriff of the county, who examined different witnesses on each point till he was perfectly satisfied of its truth. 1st, That the woman herself had never been out of the close in which she lived, during the existence of the disease in the neighbourhood. 2nd, That her son, a hawker, had slept in a house in Musselburgh in which a woman was dying of the cholera, on the Monday. 3rd, That after returning to town, he was seized on Wednesday with vomiting and purging of whitish or watery matter, cramps, and feeble pulse. I saw this lad myself on that day, and immediately suspected that he had been at Musselburgh, which was at the time denied, but afterwards admitted, and confirmed by abundant other evidence. 4th, That Mrs. Mac Millan was with him during the day, in a small confined room, rubbing his limbs and nursing him, and he recovered under the use of opiates and stimulants. 5th, That on the Saturday, when he was convalescent, she was seized with the disease in its most virulent and unequivocal form, and died in ten hours. Now I presume it will not be denied that the epidemic cholera, which was never known in Edinburgh before 1832, and has not been seen in it since 1833, must have some cause or causes of local and temporary existence only. That the lad Mac Millan, who had slept a night at Musselburgh, (then much affected with the disease,) should be seized with it, proves nothing as to the question whether intercourse with the sick has the power of exciting the disease or not. But if that intercourse has no such power, it is plain that his mother, who never left her own close, had no more business to take the disease than any other of the inhabitants of Edinburgh or Leith, and her infection must have been a mere chance. The chances therefore, are, nearly 160,000 to 1 against her being the first person in Edinburgh or Leith who should take the disease, and almost infinite to one against her being infected by it within sixty hours after her son.

"'From the time therefore,' Dr. Alison adds, 'when I was satisfied as to these facts, I have never doubted of the disease having a contagious property, although I have never thought it proved that its extension is to be ascribed to that property alone.'"

"In many of the more isolated cases which occurred during the prevalence of cholera in Edinburgh, the evidence of previous exposure to the infected could not be distinctly ascertained.—(See on this subject Dr. Craigie's able Monograph upon the disease in this city, in the Edinburgh Medical Journal, vol. xxxix. p. 366, &c.)

"In each of the three instances we have next to bring forward,

the city of Glasgow formed the infected focus from which the infection was carried."

"*Campbelton.*—In this town, which contains between 9,000 and 10,000 inhabitants, and is situated on the west coast of Argyleshire, there were two separate irruptions of cholera in 1832; the first in April, and the seeond towards the latter end of July. During the first irruption only thirteen cases occurred, ten of which were fatal; and through the kindness of Dr. Macdonald, of Ballyshear, I have been favoured with some notes of them drawn up by Dr. Macintyre of Greenock, who was, at the time mentioned, surgeon to the cholera hospital at Campbelton. The first case is remarkable on account of the latent stage, and of the premonitory diarrhœa. 1. Archibald Witers, aged 28, went from Campbelton to Greenock and Glasgow early in April. He himself confessed, (as I am informed by Dr. Macdonald, and the same, Dr. Macintyre states, was admitted by Witers' mother,) that while in Glasgow he slept in a house where cholera existed. In returning home he came by a steamboat to Tarbert, and travelled from thence to Campbelton by land, (a distance of thirty-seven miles,) without entering any house on the road. He reached town on the 10th April. On the 15th he was attacked with diarrhœa, and by the morning of the 17th had also some nausea and vomiting. Dr. Macintyre visited him at 4 o'clock P. M., on the latter of these days, (the 17th,) and found him affected with all the characteristic symptoms of malignant cholera. On the 19th, however, he was convalescent, and had no consecutive fever. 2. Mary Morrison, aged 7, who had been in Witers' house when he was ill, was seized at 7 P. M., on the 20th, with decided cholera, and died in twenty-two hours. 3. Mrs. Morrison, the mother of No. 2, was attacked with the disease at 6 A. M. on the 21st, and sunk in about twenty-one hours. 4. Mrs. Witers, the mother of No. 1, who had attended and nursed her son during his illness, sickened in the afternoon of the 21st, of cholera, and died on the 22nd. This last patient died in the cholera hospital. 5. Alexander Macneil, aged 70, residing in a street about 600 yards distant from that in which Witers' and Morrison's houses were situated, was attacked with cholera symptoms on the forenoon of the 22nd April. 'He had,' Dr. Macintyre remarks, 'been in conversation with one of the hospital attendants the night previous, and had been working, I believe, with Witers on the 15th and 16th, when the latter was suffering under diarrhœa.' Macneil died on the morning of the 23rd. 6. His wife, aged 70, was seized with the disease 12 o'clock noon, on the 25th April, and died after an illness of thirteen hours. 7. A girl, Sinclair, sister-in-law to one of the porters at the hospital, was taken ill on the 23d, but ultimately recovered. 8. Mrs. Christie, aged 38, sickened on the morning of the 28th, and died on the 29th. 9. Her husband, Malcolm Christie, was attacked at 5 A. M., on the 29th, and died on the 30th. 10. Robert Wishart, residing in a house adjoining to that of Christie, was seized at 4 A. M. on the 30th, and died at 8. P. M., of that day. 11. Mrs. Wishart, aged 35, wife of

No. 10, was attacked the same day at 5 A. M., and died next morning, 12. Donald M'Killop took the disease on May 1st, and died on the succeeding day. 13. Fawcett, aged 4, living in the same house with the Wisharts, (Nos. 10 and 11,) was attacked on the 3rd, but recovered. Dr. Macintyre does not state, in the communication which has been put into my hands, whether or not any intercourse, direct or indirect, was traced between the Christies, Wisharts and M'Killop, and those previously affected.

"The thirteen cases that have been mentioned, all occurred within the space of eighteen or twenty days. After the last of them, (Fawcett's) on the 3rd May, no other cases of cholera were seen in Campbelton, till the 28th July, when the second irruption of the disease occurred, and between that date and the 28th October, 98 of the inhabitants were attacked with cholera. No importation of the disease in this second irruption could, as has happened often in regard to the subsequent returns or recurrences of the disease in other places, be distinctly ascertained.

"*Greenock.*—Mr. Turner, surgeon, Greenock, has kindly favoured me with the following facts relative to the first introduction of cholera into that town.

"1. Dow, an elderly fishmonger, belonging to Greenock, went to Glasgow in the latter end of February 1832, and slept in that city in a tenement in which cholera was at that time raging. Next day he came to Greenock labouring under a diarrhœa, which, after continuing for two days terminated in all the more marked and fatal symptoms of confirmed cholera, and the man speedily sunk. 2. Mrs. Black, who officiated as nurse to Dow, took the disease next day, and also died. 3. On the following day Dow's wife was attacked, but recovered.

"4. A fisher boy, the name of M'Millan, who was some hours in company with Dow, and drinking with him on the day he came from Glasgow, and when he was labouring under the premonitory diarrhœa, was seized with cholera that night, and died on the following one in the hospital. 5. Next day this boy's mother took the disease, and died in a few hours. 6 and 7. On the following day his father and brother had also a severe attack of cholera, but their cases did not prove fatal. The disease subsequently spread through Greenock to a considerable extent. The boy M'Millan had been out with his boat in the river, fishing, but with this exception and that of Dow, who had been in the infected house in Glasgow, none of the other persons who have been mentioned had been for a considerable period out of Greenock, and the disease had not been previously seen in that town. In other words, Dow's nurse and mother, M'Millan, his mother, father, and brother, had only had intercourse with a previously infected locality, *indirectly* through the person or body of Dow, who had been, as already stated, exposed to the disease in his lodgings in Glasgow.

"*Doura.*—At the small village of Doura, in Ayrshire, containing 37 families, and 170 inhabitants, not less than 21 cases of confirmed

cholera appeared. The first case which occurred was in a young woman, who had, on the 20th February, 1832, travelled on foot with her husband from Springbank, near Glasgow, where the disease was then raging, to Doura, a distance of about twenty or twenty-two miles. She was intending to proceed onwards to Kilwinning, but she was seized with purging and vomiting on the road, and was so ill and exhausted by the time she reached Doura, that she could proceed no farther, and took up her abode in the village, in the house of an acquaintance. She expired the following evening, after having exhibited all the best marked symptoms of cholera, as recognised by the surgeon in attendance, who had seen the disease in India. The stranger was attended by two female villagers, (sisters,) who rubbed her, &c. One of these sisters was attacked with cholera on the 24th, and died after twelve hours' illness. On the 25th, the other took the disease, but recovered. No restrictions whatever as to the intercourse with infected persons, were put in force, and so rapidly did the disease spread, that by the 9th of March, 21 cases in all had occurred among the above mentioned small population.

"In this instance, as in several others which we have mentioned, a person travelling from an infected district, and actually labouring under symptoms of cholera, appeared to carry the disease through a line of healthy country to a distant locality. No case of cholera existed at the time any where near to Doura, and immediately previous to the arrival of this woman, the inhabitants were in the enjoyment in every respect of their usual state of health; yet, within the space of seventeen days after the infected stranger arrived among them, one out of every five individuals in the place was attacked with confirmed cholera; six died of it; and almost every inhabitant was affected in a greater or less degree with diarrhœa. (See Mr. Salmon of Frome's Letter in the Lancet for 1832, p. 182, and also Mr. Moir's Proofs of the Contagion of Malignant Cholera, p. 64.)"

"*Carnwath.*—In the parish of Carnwath, Lanarkshire, containing a population of about 5000 individuals, five cases of pestilential cholera were observed during the prevalence of the disease in this country in 1832-33, and the first of them was imported. Dr. Wilson, who was chairman of the local board of health, has favoured me with the following particulars relative to the history of these five cases.

"The first instance of the disease was observed in the person of a stranger of the name of Waters. This man was a native of Beith in Ayrshire. He was travelling homewards to his native place, asking charity, after having a few days previously left off his employment as a mason in the more eastern districts of the country, where the cholera was raging. It was not ascertained from him at the time whether he had been directly exposed in the east to the contagion of cholera, but he was taken ill with the premonitory symptoms of the disease on the road, at some distance from Carn-

wath, and when he reached Braehead, (a village in that parish containing about 150 inhabitants,) on the —th of June, 1832, he was *already* labouring under a bowel complaint, and unable to proceed farther. He took up his quarters in Braehead, in a lodging house kept by a person of the name of Telford, and all his symptoms having speedily become more severe and characteristic of cholera, he was sent onwards in a cart by the alarmed villagers, into the adjoining parish of Carstairs. He died either that night or on the following morning.

"The day on which Waters was removed from the lodging house in Braehead, one of Telford's (the lodging house keeper) daughters, and Jean Gibson, cleaned the clothes of the house, and were both taken ill that evening. Gibson died within thirty hours with the most distinct symptoms of cholera; but the girl Telford recovered after a severe attack. At this time two hawkers (a man and his wife) came to Telford's. They both sickened with cholera, the woman recovered, but the man died after a few hours' illness.

"The local board of health adopted every possible measure to prevent the spread of the disease. No other cases of cholera previously or subsequently occurred in Carnwath, or any where within a circuit of country of seven miles extent, at least, around it.

"*Glen.*—This is a healthy little village, situated about two miles south of Falkirk, Stirlingshire, and inhabited by between thirty and forty families of colliers. In April, 1832, eight cases of cholera occurred in it, the two first of which were in individuals who had been exposed to the contagion of the disease in another distant locality. My friend, Mr. Graham of Polmont, who has the villagers under his professional charge, has furnished me with some interesting particulars regarding the history of the disease among them.

"1 and 2. Robert Anderson and his wife, after spending some nights at Airdrie, (about fourteen or fifteen miles distant,) in a house where some of their relations had died of cholera, returned from thence to Glen on Wednesday, the 4th April. At the time of their arrival were both labouring under the premonitory diarrhœa, and, as was afterwards confessed, they were themselves convinced that they had taken cholera. They kept their complaints, however, as secret as possible, in consequence of the strong feelings of prejudice then existing regarding it, until Sunday the 8th, when Mr. Graham was sent for by the overseer of the mines at the village. The woman was by that time collapsed, and died next night. Anderson himself had the characteristic diarrhœa to a great extent; but being of a strong constitution, he ultimately rallied after lying in a state of collapse for thirty-three hours. 3 and 4. Two of Anderson's children, who had remained at home while their parents were visiting the infected house of their relatives in Airdrie, were seized with distinct, and in one of them severe symptoms of cholera on the 12th. They both recovered. 5. A man, named Benny, was suddenly taken ill with all the symptoms of cholera on the morning of the 10th. He was immediately subjected to active medical treatment, and

recovered. Jenckens, another man, was similarly attacked on the evening of the same day, and also did well. Mr. Graham does not state what particular communication the two last persons, Benny and Jenckens, had with the Andersons. 7. A daughter of Jenckens, (No. 6,) was attacked on the 11th: and the 8th and last case occurred on the 15th, in the person of Alexander Brown, who had gone repeatedly to look at Anderson's wife while she was dying.

"*Ferryden and Boddin.*—The following facts with regard to the introduction of cholera into Ferryden and Boddin, two villages in Angus-shire, Scotland, have been drawn up by Dr. Brewster, the brother of the distinguished Sir David Brewster, and clergyman of the parish in which Ferryden and Boddin are situated. I am indebted for the communication of them to Professor Alison.

"The village of Ferryden is placed on the south bank of the South Esk, opposite to the town of Montrose, and contains about 700 inhabitants. The district of country in which it lies, remained altogether free of cholera, when in 1832, and the earlier months of 1833, the disease was prevailing in different parts of the kingdom. In the end of June, 1833, the smack Eagle, from London, arrived at Montrose. Two cases of cholera had occurred amongst the crew during the passage from London, one soon after the smack left that port, and the other off Harwich. As soon as the vessel reached Montrose river, the crew dispersed to their several homes. One of them, Robert Findlay, an inhabitant of Ferryden, carried his clothes and bedding to his house there. A day or two afterwards, two children in the village, who were reported to have been seen tumbling during the preceding day on Findlay's mattress, as it was laid out to the air, were seized with rapidly fatal cholera, and died on the 2d of July; and this, it may be proper to remark, took place at a time when the disease was considered to have nearly or entirely disappeared from Scotland. On visiting Ferryden that day, Dr. Brewster found the mother of the two children labouring under a fatal attack of cholera. The malady subsequently spread through the village, but not rapidly; and during the four weeks it continued, it carried off 27 out of the 700 inhabitants, or nearly one out of every twenty-seven of the residents. It appeared (Dr. Brewster observes in the communication with which I have been favoured) in different parts of the village in succession, and almost uniformly among the relatives, visitors, and neighbours of those who were previously affected. Out of the few cases, he adds, which appeared in Montrose, two were relatives of the sick in Ferryden, whom they had gone to visit there, and were themselves seized with the disease after their return home. The inhabitants of the adjoining district of country in general, carefully avoided all communication with Ferryden, and the disease only appeared in one other part of the parish, viz., in Boddin, a small village on the sea coast, nearly three miles south from Ferryden. Only two cases occurred in this locality, but these two afforded strong corroborative testimony of the

contagious property of cholera. Margaret Stott, a young woman, an inhabitant of Boddin, went to visit her sister at Ferryden, and upon returning to Boddin, was seized with the disease, and died in two days. Jean Peterkin, an aged woman, who lived in the house adjoining to that of Stott, and who had not been out of the village, assisted, amongst other things, in putting Stott's body into the coffin, and afterwards washed her bedding. In the course of two or three days she had a fatal attack of cholera. No other person (Dr. Brewster adds) in the village of Boddin, or in the parish, or in the surrounding district, with the exceptions now noticed, was affected by the disease."

In addition to the above important facts detailed by Dr. Simpson in his *brochure*, he has furnished me with the following table, compiled carefully from authentic information, and exhibiting the dates of the arrival of cholera in many places in Scotland. He adds, on the authority of Professor Traill, that cholera never reached the Orkney or Shetland Islands, although it was as far north as Thurso.

A list of several towns and villages in different parts of Scotland which were visited with Asiatic Cholera, showing the date of its appearance in each particular locality.

TOWNS.	DATE OF APPEARANCE.
Haddington,	17th December, 1831.
Edinburgh,	See Dr. Craigie's paper in the Edin. Med. Jour. vol. xlix.
Tranent	12th January, 1832.
Musselburgh,	19th January, 1832.
Leith,	26th January, 1832.
Kirkintulloch, seven miles from Glasgow,	21st January, 1832.
Glasgow,	12th February, 1832.
Paisley,	13th February, 1832.
Greenock,	26th February, 1832.
Falkirk,	About 3d March, 1832.
Doura, near Kilwinning, Ayrshire,	6th March, 1832.
Perth,	13th or 14th March, 1832.
Inverary,	21st May, 1832.
Water of Leith, near Edinburgh,	12th March, 1832.
Rothsay,	23d March, 1832.
Larbert, near Stirling,	Before 1st April, 1832.
Fort George,	7th May, 1832.
Dundee,	23d April, 1832.
Stirling,	10th July, 1832.
Helensdale, on the confines of Caithness and Sutherland,	About 23d July, 1832.
Portpatrick,[1]	7th August, 1832.
Ayr,[1]	About 15th August, 1832.
Aberdeen,	27th August, 1832.

[1] "See some additional dates in my Paper on Cholera."—*Dr. Simpson.*

TOWNS.	DATE OF APPEARANCE.
Cupar, in Fife,	30th August, 1832.
Tain,	8th September, 1832.
Inverness,	24th August, 1832.
Dumfries,	15th September, 1832.
Fort William,	24th September, 1832.
Crieff,	2d October, 1832.
Hawick,	About 20th October, 1832.
Island of Islay,	About 23d October, 1832.
Kelso,	About 29th October, 1832.
Nairn,[1]	About 11th August, 1832.
Wick,[1]	21st July, 1832.

It is exceedingly remarkable how many of the great towns of England either escaped infection altogether, or were visited by only a trifling outbreak of the disease.[2] Up to the 24th of June, 1832, (that is during a period of about eight months since its first appearance at Sunderland,) the total number of cases throughout Great Britain, inclusive of London, amounted to only 14,796, and the deaths to 5432.[3] The disease, it is true, continued in many places to linger long after the above date, and reappeared as an epidemic in some places in 1833 and 1834, but still we are quite warranted in concluding, that on the whole, in Great Britain and Ireland, the cholera did not count 30,000 victims. In Ireland, particularly in Dublin and Sligo, the mortality was much greater than in England, an occurrence which may, perhaps, be accounted for by the bad diet of the Irish lower classes, and the crowded state of their dwellings, it being well known that in the worst quarters of the city, many families reside on the same floor, and frequently more than one in the same room. "In London," says Dr. Elliotson,[4] "the greater part of the people are well fed, better fed than in any other part of the world; they eat more meat, and that flesh is of such quality as scarcely to be found in any other country; besides which, they are better clothed, and more comfortable, and instead of trashy wines they have good sound ale and porter, and malt liquor of all kinds. But in Paris, the water the inhabitants drink is very bad; the people are crowded together, I know not how many families in a house, with little ventilation; the streets are narrow, the houses dirty, and the population live upon what Englishmen consider trash, not roast beef and mutton, but all sorts of dishes made up of bread and vegetables, with a little meat boiled in water to colour it, or give it a flavour; and drink not good beer but thin wine."[5]

[1] "See some additional dates in my Paper on Cholera."—*Dr. Simpson.*

[2] Cholera commenced in Liverpool on the 12th May, and in the mean time had visited Hull, York, Leeds, Manchester, and Warrington.

[3] Medical Gazette, vol. x. p. 400.

[4] Medical Gazette, vol. xii. p. 628.

[5] At the end of this paper will be found a list *of all the towns* in Great Britain where cholera occurred.

Certain it is, no matter how we may attempt to account for it, that cholera was much more destructive in Paris than in London, 385 deaths having occurred in one day, 8th April, 1832, in the former city. Nothing has puzzled and perplexed the continental physicians more than the comparative immunity from cholera enjoyed by England, notwithstanding their predictions, that *there* its ravages would attain to a *maximum*, for they contended, that in the English towns many circumstances would contribute to render the disease more liable to spread, as for example, their very dense population, the extreme poverty and bad diet of the lower orders, and the damp, foggy nature of the climate. Now, I believe, that the reproaches made by foreigners respecting the extreme penury of the lower orders in England are not well founded, at least comparatively speaking, and with reference to the same class of persons in the continental cities; and I am persuaded that in English cities the diet of the poor is superior to that of the continental poor. Indeed foreign physicians have tried their ingenuity to account for the slightness of the ravages of cholera in Great Britain, some attributing the immunity to tea, some to the quantity of meat we consume, and some to the vapours arising from our numerous coal fires; and each of these hypotheses has been met by objections, for the Chinese, the most national tea-drinkers in the world, were wofully scourged by cholera; and the city of Halle, in Germany, the most devastated town of that kingdom, uses nothing but coal for firing. It is to the more substantial nature of English fare, to the superior cleanliness of that nation, and to their living in families separated from each other, that we must attribute their comparative exemption from cholera, an exemption the more remarkable, when we consider that in England, commercial and private travelling between town and town is more rapid, and ten times more frequent than on the continent.

Cholera first appeared in Paris on the 24th of March, 1832, and it has been argued by those who deny the contagious nature of cholera, and its importation from abroad, that in France it broke out suddenly, not on the confines, but in the heart of the kingdom, and consequently, that it must have arisen spontaneously in the metropolis. Before we attach much weight to this argument, we must have very strong proofs that the facts are as above stated; now it is very remarkable, that cholera was officially announced to exist at Calais only eight days after it appeared at Paris, and when we recollect how unwilling the authorities in all seaports of hitherto uninfected nations, have invariably been to acknowledge the existence of cholera, it is not by any means improbable that cholera may have existed in Calais before it broke out in Paris, a supposition confirmed by the report of Arnaud, Moribaud, and Gendrin, who witnessed in Calais, towards the end of 1831, many very violent cases of cholera greatly resembling the Asiatic; nay, even after the cholera had manifestly appeared in Calais, many persisted in declaring that its victims died of common enteritis.

Indeed, according to Moreau de Jonnes, (Lancet, 1832-33, p. 689,) cholera appeared at Calais on the 15th of March, and at Paris on the 24th; so that France cannot be considered as forming an exception to the general rule, that the *disease always appears in seaport or frontier towns, before it makes its way to the centre of any country.* Once arrived at Paris, it spread in every direction. The following observations are from Moreau de Jonnes: "The disease spread by contiguity, as in the other parts of Europe, following lines, of which Paris was the centre, ramifying with the communications through the country. In each department, the time of the irruption was sooner or later after that of Paris, in proportion to the distance from, and the frequency and rapidity of the communications with the capital. Thus the following departments of the east became infected in the following dates, viz:—

Seine,	March 24, 1832.
Seine and Marne,	April 2, "
Marne,	" 16, "
Meuse,	" 11, "
Moselle,	" 27, "
Meurthe,	May 4, "
Vosgey,	" 13, "
Hante Saonne,	June 16, "

"In the western departments the disease broke out as follows:—

Seine,	March 24.
Seine and Oise,	" 28.
Eure and Loire,	April 8.
Indre and Loire,	" 19.
Deux Serres,	" 25.
Vendeé,	July 10.
Charente Inferieure,	August 4.
Charente,	" 30.

"The degree of rapidity with which the disease spread in different directions is as follows: Cholera appeared in Calais on the 15th of March, 1832, and broke out at Arles on the 17th of September following, having thus, in 186 days, traversed 200 leagues, forming the great diameter of France from north to south. The disease was recognized in Paris, the centre of the kingdom, on the 24th of March; on the 27th of April following, it had spread by contiguity to the department of the Moselle, and on the 11th of May, to that of Finisterre, taking thirty-five days to reach the eastern, and fifty days to arrive at the western frontier of France; having traversed on the one side seventy leagues, and on the other one hundred and twenty.

"Thus the cholera traversed France, from north to south, at the rate of one league in twenty-four hours; whilst from east to west, it required but eighty-five days to travel a distance of 190 leagues, which gives a rapidity greater by one half."

These statements of Moreau de Jonnes, are of the greatest im-

portance. We see cholera introduced probably from England to Calais, and immediately after to Paris, from which it radiated in all directions by slow and varying stages all over the kingdom. The position of Paris, and its daily communication with England, rendered it almost the first prey of the disease in France. Once there, the cholera moved along the different lines of communication in every direction, its route not governed by any of the laws observed by epidemics depending on atmospheric changes; and its gradual progress from Paris, as a centre, towards all parts of the circumference of France, presenting a course obviously opposed to that of such epidemics. The following quotation relative to cholera in Paris is taken from Dr. Simpson's *brochure*.

"*Paris.*—Mr. Velpeau, in an essay on the cholera in Paris, contained in the twenty-ninth volume of the Archives Générales de Medecine, mentions several examples of the contagious propagation of the disease in that city; and we can only consider his testimony to the doctrine of contagion as the more impartial and valuable, seeing that he was one of those medical men who signed the celebrated official document, on the fourth day of the appearance of the malady in the French metropolis, denying altogether its contagious character. 'Out of eighty and odd cases, (he remarks, p. 224,) in this city, the history of which I have noted, there is none the subject of which had not some previous communication, direct or indirect, with other cholera patients.' Among other series of cases he gives the following, (p. 222:) 'A man, aged 55, had remained near two of his friends who were affected with cholera. He was attacked himself, three days afterwards, at his own house, (Rue Vieille du Temple,) and died in eight hours. 2. His eldest son, aged 23, who took charge of his father to the last moment, was attacked next morning, and died in seventeen hours. 3. The mother; 4, next the daughter; 5, then another son, who came from his work to the assistance of his sister, were successively attacked with the disease, but in a less severe form. 6. A child of ten years, who came to visit them, was also seized. 7. An artist living in the flat above was next affected, as well as, 8, his wife; and 9, another person died of the disease in the same house, which (M. Velpeau adds) was not more insalubrious than the neighbouring habitations. The above persons were all (he likewise states) regular in their habits, and in comfortable circumstances.'

"In the surgical ward, St. Jean, of the Hospital La Pitié, cholera (M. Velpeau again observes, p. 225,) did not appear till after the nurse attached to it had been engaged in attending cholera patients in the medical wards. The first person attacked in the ward passed constantly by the bed of the second. The third occupied the bed nearest his, and the servant of the ward was next seized. A fifth, sixth, seventh, and finally an eighth case occurred among the persons lying in the beds nearest those attacked. 9. A young pupil, who, up to that time, had abstained from visiting cholera patients, came to the hospital in the morning. He was affected with cholera

that night at *his own house;* and 10, his brother, who lodged in the same room with him, had a fatal attack of it on the following day."

From England cholera soon spread to Ireland; the following dates of its arrival were communicated by Dr. Barker, whose official situation in the Board of Health, gave him the best opportunity of ascertaining the progress of the disease.

PLACES.	DATES OF OUTBREAK OF CHOLERA.
Dublin,	22d March, 1832.
Arklow,	8th April, "
Banbridge,	9th April, "
Cork,	12th April, "
Ramelton, County Donegal,	12th April, "
Naas,	13th April, "
Belfast,	14th April, "
Warren's-point,	17th April, "
Stranorlar, County Donegal	22d April, "
Tralee,	28th April, "
Galway,	12th May, "
Limerick,	14th May, "
Waterford,	1st July, "
Wexford,	21st August, "

It is worthy of remark that Dublin, Cork, and Belfast were affected about four months before Waterford and Wexford. Now a steamer plies twice a week between Dublin and Cork, and Dublin and Belfast, *while there is no direct communication by steam* between Dublin and Waterford, or Dublin and Wexford; and consequently it appears probable, from the dates, that Cork and Belfast were infected from Dublin, while Waterford and Wexford escaped for many months, not being exposed to infection from this source. At all events, the fact that Waterford and Wexford should have remained so long without the disease is very remarkable, and if not sufficiently accounted for by their more indirect and less frequent intercourse with Dublin, it may perhaps be explained by their trade with England consisting chiefly of the export of agricultural produce, rather than the interchange of passengers.

We have hitherto followed the route of cholera in the old world; we have now to trace it in the new.

"The disease commenced about the 8th of June, 1832, in Quebec, in boarding houses and taverns in the *Cul de Sac*, a low, uncleanly, and ill ventilated part of the city, crowded with emigrants of the lowest description, with sailors, and other persons of irregular habits."[1]

[1] Vide the official Report of the Board of Health, Quebec Cholera Gazette, p. 72.

Thus we find that cholera appeared in America first at Quebec, just at the season when the spring stream of emigration from England reaches that city. The following account proves that cholera might be thus transmitted.

"The following letter from the surgeon of the British barque Brutus, to the president of the Board of Health of Liverpool,[1] conveys the melancholy intelligence of the cholera having broke out among the passengers, *eight days after* leaving the river Mersey, and which induced the captain to put back. It appears from a statement subjoined to the letter, that between the 27th of May, the period when the first person was attacked, and the 13th of June, the day on which the vessel arrived at Liverpool, 117 cases had occurred, 81 died, and 20 had recovered.

'Sir,

'With the deepest feelings of regret, I have the painful duty to perform of transmitting to you one of the most melancholy and distressing accounts of cholera, which occurred on board the British barque Brutus, bound for Quebec, from Liverpool, with three hundred and thirty passengers. The first case presented itself on the 25th of May, (being the eighth day after we left the river,) in a strong, healthy man, thirty-five years of age; the symptoms were all well marked, the spasms particularly severe; under the usual means of treatment he recovered. The next case was an old woman of sixty, who died in ten hours after the commencement of the attack. The disease continued gradually to increase, (notwithstanding every means having been employed to arrest its progress,) until the night of Saturday, the 2d of June, when we were a good deal tossed about by a heavy sea, and dark hazy weather; it spread to such an alarming extent, that on Sunday, most of the ship's crew being attacked, and having lost some of them the week before, we were obliged to bear up again for Liverpool. It is impossible to describe the scene of misery on the third, fourth, and fifth, people dying in every direction—the greater number of them destitute of the common articles of bed covering. On the sixth, the weather became more favourable, the disease less severe, and the number of new cases diminished, which has since been on the decline.

'I have the honour to be, sir, your obedient humble servant,

'W. W. Thompson, M. R. S. C. in London.'"

"*Brig Amelia.*[2]—On the 19th October, 1832, the brig Amelia left New York (a city in which epidemic cholera at that time prevailed) for New Orleans. The brig had on board her ordinary crew, and one hundred and five passengers, some of whom had the disease *before* sailing; on the sixth day out, the sickness, according to the captain's subsequent official deposition, commenced in the vessel; and in the course of eight days more, or, in other words, by the 31st of October, twenty-four of the individuals on board had

[1] Cholera Gazette.
[2] Dr. Simpson's brochure.

died of it, and several more were labouring under the disease. During the course of this last-mentioned day, (31st October,) the vessel was stranded on the beach of Folly Island, a low and sandy island about twenty miles from Charlestown, and far out to seaward.

"The island was the property of a Mr. Milne, who kept four negroes upon it as permanent occupiers, and used it himself as an agreeable summer retreat. Mr. Milne allowed the captain, passengers, and crew of the brig to take refuge in his buildings. The deputy port physician of Charlestown, Dr. Elfe, was sent down to visit the island, and pronounced the disease which he found there to be cholera. A boat's crew of wreckers who had gone down from Charlestown to the island to attempt to save the vessel and cargo, having returned to the city, one of the men belonging to the crew was there seized with well, marked symptoms of malignant cholera, and died. The rest of this boat's crew of wreckers were ordered back to the island to perform quarantine, and after having embarked, two fell sick, and one died of cholera on their passage down. Two physicians, Drs. Jewey and Pritchard, were sent to the island to afford the necessary assistance, and being worn out by constant exertions, they were relieved in the course of a week by a third medical officer, Dr. Hunt. There were sent down also from Charlestown a clergyman, the man who had nursed the wrecker that died in the city, and a lieutenant and eighteen men of the city guard, the latter being ordered to the island to perform the duty of a *cordon sanitaire*, and to prevent any individuals from leaving the spot. The wreck of the brig was burned on the 8th November. New cases, however, of cholera continued to occur up to the 17th; and it is important to remark, that some of those who were attacked had never visited the brig.

"In this way there were collected upon Folly Island about one hundred and fifty individuals in all; and amongst these there occurred up to the 17th November twenty-three deaths, or sixteen per cent. of the number fell victims to cholera, including twelve of the passengers landed from the brig, six of the wreckers from Charlestown, (not reckoning the one who died in Charlestown, and the other who died in the passage down,) three of Mr. Milne's four negroes, the nurse, and one of the city guard from Charlestown. Of the other seventeen men belonging to the city guard, and whom it was found impossible to prevent from communicating with the passengers dispersed over the island, every one was affected more or less with the symptoms of cholera, with the exception of the lieutenant; and nine of them were reported to have been attacked seriously. One of the three physicians, Dr. Hunt, was attacked on the 17th by the disease, but recovered.

"*Smack Trusty.*[1]—The Leith and London smack Trusty arrived

[1] "The following case of the Trusty has been already imperfectly, and, in several respects, inaccurately stated in Mr. Moir's Proofs of Contagion, p. 71; and in the Cholera Gazette, p. 264. To ascertain as accurately as possible every particular connected with it, I visited last summer the quaratine

at London on the 19th of February, and after remaining in port for fourteen days, sailed again on the 4th March, with ten of a crew, including the captain and mate, and six passengers on board. In London the cholera was then prevailing to a considerable extent, more particularly on the side of the river, and in the quarter connected with the shipping. 1. On the morning of the 6th, the cook was attacked with cholera at sea, and died on the 7th. 2. Another seaman complained of headach when the vessel was brought up in Leith Roads, (a distance of about 400 miles from London,) on the evening of the 8th. This man assisted on the same night another of the crew and a cabin boy to pull ashore the six passengers in the boat belonging to the smack. When he reached the harbour, however, he found himself so unwell as not to be able to return on board, and died of cholera the next morning in the Leith Hospital at 12 o'clock. This was the second case of the disease observed in Leith, the first having occurred about a month previously in a man who had been visiting his infected relations at Musselburgh. 3. The other sailor who landed with him was also obliged to remain on shore, and had an attack of cholera that night, but recovered. 4. On the morning of the 9th, another of the crew of the smack was seized with vomiting and purging immediately after the preventive boat visited the smack in the Roads; and the vessel having been ordered ten miles up the river to the quarantine station at St. Margaret's Hope, he was, when the vessel arrived there about 5 o'clock of the same evening, transferred to the hospital ship Nymphe. The Nymphe (one of the old men-of-war employed as quarantine vessels in the station) had been previously cleared out as an hospital ship to receive a suspicious case of cholera which had occurred on board one of the vessels under quarantine, on the 2d March, but this man had been discharged as well on the 5th. At the time that the sailor from the Trusty was placed in the Nymphe, on the evening of the 9th March, the Nymphe had only two mariners left on board, who had volunteered to act as nurses. On the 11th, two other mariners were joined to these, and on the 16th a fifth was added. The sailor from the Trusty had a severe attack, but continued in life till the 16th. 5. In the afternoon of the 10th, a second sailor was transferred from the Trusty to the Nymphe labouring under cholera: he recovered. 6, 7. On the 11th, two new men were attacked and sent to the Nymphe, both of whom died. One of them was a Leith porter, who had come on board the vessel in Leith Roads, having returned with the boats which landed the passengers. He and the pilot (who had joined the smack

station, and had an opportunity of conversing with one of the nurses who was attacked, and with other persons officially employed there during the existence of the disease. I got access also, through the kindness of Dr Forsyth of Inverkeithing, the quarantine medical officer, to the quarantine official ship journals, in which the state of the sick, the arrival and release of all vessels, the condition of their crews, and all other correlative circumstances, were minutely entered twice a day."—Dr. Simpson's brochure.

near the mouth of the river in Dunbar Bay) having been found on board by the officers in the preventive boat, were obliged to proceed with the vessel to the quarantine station. This porter, Murray, was cut off by the disease after an illness of only twelve hours' duration. 8. On the 12th, another of the crew of the Trusty was attacked and transferred to the Nymphe, but recovered in the course of a few days.

"Thus out of the whole crew of the Trusty, ten in number, one died of cholera at sea; a second on shore at Leith; a third remained there, but recovered; a fourth, whose case proved afterwards fatal, sickened while the vessel lay in Leith Roads. Three others were attacked in St. Margaret's Hope, and sent on board the Nymphe; and of these three one recovered and two died. The porter who joined the vessel at Leith also took the disease there, and died. The three remaining members of the crew, and the pilot, who came on board in Dunbar Bay, had each an attack of diarrhœa.

"Of the *five mariners* who acted as nurses to the crew of the Trusty on board the hospital ship, one was attacked with cholera during the afternoon of the 15th, and died in less than twelve hours. On the 24th, another of them was attacked with nausea, vomiting, purging, and tenesmus, but recovered. On the morning of the 27th, a third is reported in the ship's journal as attacked with the premonitory symptoms of cholera, but is entered as better on the 28th and 29th. On the evening of the day on which the third nurse was attacked, a sailor was sent on board the Nymphe from a second infected vessel that had arrived in the quarantine ground, but up to that day only the men of the Trusty had, with the exception formerly noticed, been on board of her as patients."[1]

Had the Brutus been less severely visited, the captain would, no doubt, have held on to his destined port; and the passengers, for their own sakes, would have spoken of the occurrence of cholera on board their vessel as little as possible, and so the matter would have been hushed up. The occurrence of 81 deaths at sea, among less than 350 persons on board the same vessel, cannot be accounted for, unless on the supposition that the disease is contagious. One such positive fact is worth a volume of negative evidence.

On the 10th of June, 1832, it appeared at Montreal, and here, as at Quebec, it immediately assumed the character of a most destructive pestilence.

The following interesting account[2] of the route of cholera during the first stages of its progress in North America, is from the pen of S. Jackson, M. D., Secretary to the consulting Medical Board of Philadelphia. Dr. Jackson is a non-contagionist, as will abundantly appear from his narrative, upon some of the leading facts of which I may hereafter take occasion to make a few observations. It is worthy of remark that the medical men of America have far outstripped their European colleagues in medical statistics. The

[1] Dr. Simpson's brochure. [2] Cholera Gazette.

weekly, monthly, and annual accounts of diseases, deaths, &c. in each of their great cities have been long published systematically and regularly, and that with a degree of accuracy to which we are strangers. Some of the results of this praiseworthy habit appear in Dr. Jackson's account.

"From the numbers of emigrants, who, about this period, had landed at Quebec, and arrived at Montreal from England and Ireland, a first impression was created, that they had been the means of transmitting the epidemic across the Atlantic. A more close investigation into the facts connected with the commencement of the disease in those cities, served to destroy this supposition. It could not be traced to importation. The emigrants and lower classes of the Canadians were attacked simultaneously in both cities. Numbers of the emigrants were in circumstances eminently predisposing them to suffer attacks of the disease, and they and the lower Canadians were precisely the description of persons most obnoxious to the ravages of epidemic cholera, and such as have been universally observed to be its first victims.

"The lines of communication between the cities of Quebec and Montreal, and the cities of the United States, are by the Richelieu River, Lake Champlain, and the northern canal leading to Troy and Albany; or by the St. Lawrence to Lake Ontario, to Buffalo, and by the Erie Canal leading to Rochester and Albany. It was confidently expected that the disease would penetrate into the United States from Canada by these routes. Along the first, many cases of the disease did certainly occur in the persons of emigrants, but they terminated without its communication to others. On the contrary, the epidemic manifested a decided predilection for the shores of the St. Lawrence, successively attacking the towns and villages along its banks, then following the borders of Lake Ontario, until it entered Lake Erie.

"While attention was directed to the northern and western boundary, supposed to be threatened by the invasion of the disease, it suddenly and most unexpectedly appeared in the city of New York.

"The first case occurred, it is said, on the 24th of June, when a man, a native citizen, residing at the corner of Gold and Frankfort streets, was attacked by the disease. Four cases soon succeeded, the location of which was in Cherry street. The subjects were Irish emigrants, who had arrived in Quebec in the autumn of 1831, and had resided in Albany until the month of May, when they removed to New York.

"On the 27th June, the disease manifested itself in Bellvue Alms-house, distant about three miles from the city. The patient was an aged woman who had not left the house for three years, who had held no communication with the city, and no admission into the ward she occupied had taken place for a month. Several cases immediately ensued in this and the other wards of the house.

The epidemic reached its maximum in this establishment on the 11th July, and terminated on the 4th August.

"In the city of New York, the climax of the epidemic arrived on the 11th of July, from which period it continued very steadily to decline.

"The time that elapsed from the out-breaking of the epidemic at Quebec, and its appearance at New York, is a period of sixteen days, or nineteen at Bellvue Alms-house. The distance between the two cities in a direct line, is four hundred and fifty miles.

"It is to be remarked that all the intermediate cities on the seaboard of the province of New Brunswick and Nova Scotia, of the states of Maine, Massachusetts, and Rhode Island, remained entirely exempt from the epidemic; and even to the present period, except in Providence, Newport, and Boston, no cases have as yet appeared.

"In this city, the epidemic was much more tardy in its progress than it had been in the Canadas, or in New York. The first decided case of cholera occurred on Thursday, July 5th. A man of the name of Musgrove, residing in the cellar of a house in Filbert street, near Schuylkill Fifth street, was attacked with symptoms of malignant cholera on that day. This man had but lately been discharged from the New Jersey prison; he had been affected with diarrhœa for two or three weeks previous to the cholera symptoms. The disease proved fatal on Sunday the 8th. The next case was a black man residing in St. John street, Northern Liberties, above Callowhill. He had been employed working on board a ship from England, lying at Pratt's wharf. He was seized with symptoms of malignant cholera the night of Tuesday, July 9th, and died on Friday. This man was perfectly sober in habits; no premonitory symptoms existed.

"No other cases presented themselves until Sunday, July 14th, when two females occupying a room in a dwelling in Coates street, a few doors above Third, were the victims of the pestilence in its most aggravated shape. Both these females were exemplary in their habits of life, but appeared to be infirm in health. The husband of one of these unfortunates had arrived on Saturday, July 6th, from New York, exceedingly alarmed respecting the cholera. He was taken sick the next day, and died on the succeeding Friday. On Saturday the widow felt unwell, and without advice took grains xvi. of calomel in the evening. She was soon afterwards seized with vomiting and purging, and in the course of the night she sunk into collapse. She died Sunday night. The mother of the deceased husband, on Sunday morning complained of feeling unwell, but without definite symptoms. Having been up with her daughter-in-law during the night, her uncomfortable feeling was attributed to fatigue. She was then going about the house, and had been out on an errand. She was requested to lie down as a matter of precaution, and a small dose of opium administered to her. This was at 8 o'clock in the morning. Dr. Schott, who

was in attendance an hour afterwards, went up to her chamber to inquire into her state. He found her lying on the floor; copious dejections of rice-water looking fluid had occurred, and she was in complete collapse: death ensued in the evening. These were the only cases to which the slightest suspicion of communication by contagion could attach; but on the same day a French woman, temperate in habits, about fifty years of age, living in Kensington, beyond the close built part of the town, at the head of West street, was also a victim of the disease. This woman had not been from her dwelling for three weeks; the house is isolated, being surrounded by kitchen-gardens for the supply of the market. She had been affected with diarrhœa since Friday, for which she had dieted, but had taken no medicine: the case proved fatal next day.

"From this time not more than three or four cases occurred, all scattered in different quarters, particularly Kensington, Northern Liberties, and Southwark, until the 27th and 28th July, when the epidemic fairly set in, and cases continued daily to be developed. The disease attained its height in this city on 5th, 6th, and 7th August, since which time it has gradually declined, and appears now to be extinct.

"Taking the 27th or 28th of July as the proper commencement of the epidemic in Philadelphia, there will be a period of twenty-four or twenty-five days intervening between its first appearance in New York, and this city. The distance in a direct line is about ninety miles.

"A comparative view of the population, number of cases and deaths in the cities, which have been brought under observation, presents the epidemic in an interesting point, and exhibits in a clear manner the character it assumed in this city.

Date of Report and Place.	Population.	Cases.	Deaths.	Ratio of Cases to Population.	Ratio of Deaths to Cases.	Ratio of Deaths to Population.
Sept. 30, Quebec .	32,000[1]	5783	3292[2]	1 in 5 1-7	1 in 2½	1 in 10½
" 1, Montreal .	28,000[3]	4385	1853	1 in 6½	1 in 2½	1 in 15 1-9
Aug. 22, New York	140,000[4]	5547	2782[5]	1 in 25½	1 in 2	1 in 15½
Sept. 13, Philadelphia	160,000[6]	2314	935	1 in 70	1 in 2½	1 in 173 29-183

"The results of this table show conclusively, that the causes productive of cholera were less numerous in the city of Philadel-

[1] "Permanent population, 27,000; transient population, 5000.—Total, 32,000.

[2] "Protestant grounds, 1244; Catholic cathedral, and cholera grounds, to 25th September, 1574; at St. Roch, 470.—Total, 3292.

[3] "Permanent population, 25,000; transient population, 3000.—Total, 28,000.

[4] "Estimated as remaining by Mr. D. Leslie.—Journal of Commerce, August 8th.

[5] "Report of the Inspector.

[6] "Population within the bill of mortality."

phia than in Quebec, Montreal, or New York, or were so modified as to possess a much less degree of activity. The causes of this result, so favourable to Philadelphia, important in the hygienic history of cholera, and consoling to humanity, as placing this formidable affection to so great an extent under control, it is interesting to investigate.

"The following are the circumstances which, existing more particularly in Philadelphia, may be regarded as influential in ameliorating the violence of the epidemic cause, circumscribing its activity, and diminishing its fatality.

"1. The plan on which the city is built, arranged in hollow squares, separated by wide and paved streets, prevents excessive crowding of inhabitants, procures free ventilation, and gives facility to the means of cleanliness. It is to be regretted that any deviation has been permitted in the original design of Penn, whose sagacity and foresight have been so amply demonstrated in the circumstances of the late epidemic.

"2. The abundant supply of wholesome water placed at the command of the whole community, affords a healthful beverage, and gives the means of the most complete cleanliness, by washing the dirty gutters of the streets, close alleys, and lanes.

"3. The well arranged measures of sanitary police, devised and actively carried into effect by the councils of the city, and the boards of commissioners of the district, and the sanitary committees appointed by them, and by the Board of Health. The measures consisted in a thorough investigation into all existing nuisances, and in their immediate abatement; in a complete system of cleanliness of the city steadily pursued; in the early establishment of numerous local hospitals, provided with ample medical attendance, nurses, and every means applicable to the treatment of the disease; and in spreading before the public early information, derived from the consulting medical committees, of the methods, hygienic, dietetic, and medicinal, best adapted for guarding against the attack of the disease, or to arrest the symptoms on its onset.

"4. A very considerable influence may be attributed to the annunciation made by the mission sent to Canada, immediately on its return, and before the epidemic had commenced its career in this city, of the different periods of the disease, and especially of the existence, in almost every instance, of premonitory signs, and a preliminary stage, with a description of the symptoms indicating its existence. This information was communicated to the public by the sanitary committee through the daily journals of the city, by handbills liberally distributed, and by placards on the corners of the streets. The board of health adopted the same measures, and pursued the same course. In this manner the whole community, before the beginning of the epidemic, were instructed in the most important points in the general knowledge and management of this affection—its commencing period, the premonitory symptoms, its general curability in that state, the necessity of immediate

attention and medical advice, and the methods of relief. These facts had been overlooked, and this attention to the instruction of the public were entirely neglected in Quebec, and Montreal, and in New York; from being taken unprepared by the epidemic, earlier than was anticipated, they were not communicated to the public until the measure had been adopted in this city, and when the epidemic there had already attained its maximum of intensity.

"5. The moral resolution, calmness, and perfect freedom from alarm and panic, generally manifested by our citizens, and inspired by a thorough confidence in the efficacy of the preventive means enforced, in the advantages for salubrity of the city, and in its medical resources, contributed in no small degree to diminish the number of cases, and the intensity of the attacks. No stores were closed on account of the epidemic, and not more citizens left the city than usually abandon it every summer. A stranger entering our streets, from the busy throng and cheerful aspect of all he met, would never have suspected the existence of an unusual and a desolating scourge.

"6. The treatment of the disease generally pursued in the city, in the preliminary stage, had most probably no small share in preventing the developement of the disease in innumerable instances. In the lighter forms, it was limited chiefly to diet, rest, tranquillizing doses of anodynes, or mild diffusibles, with occasionally the mildest laxatives or gentle cathartics, conjoined with sinapisms or other rubefacients. The drastic and perturbating cathartics were seldom if at all prescribed, and the stimulant practice but rarely resorted to.

"The foregoing circumstances appear to us as those principally instrumental in producing the favourable results attending the epidemic in this city. As such they acquire a high degree of interest, and afford most instructive lessons as regards the measures of municipal and civil regulation connected with sanitary police.

"In its general features and character, the disease differed in no respect from the many descriptions that have been made since it first attracted attention in Asia, and subsequently in its progress through Europe. It will be unnecessary to make the repetition here; it is, however, important that the fact should be signalized, that during the prevalence of the epidemic, very few persons in the city were entirely exempt from some derangement or disorder of the digestive functions. It is not probably exaggeration to assert, that two-thirds of the population were affected in this manner, which is to be attributed entirely to the epidemic influence. It should also be stated, that in the majority of cases which assumed the decided character of malignant cholera, preliminary symptoms had existed, varying in duration from a few hours to several days. In those rarer instances which were not preceded by any premonitory signs, the subjects were the aged, the intemperate, individuals who had committed some great imprudence in diet, or whose con-

stitutions had been enfeebled, and such cases were generally, if not universally, fatal.

"The disease was not confined to any one portion of the city, but extended to every district. Neither did it progress gradually from one quarter of the town where it first appeared to others, but broke out almost simultaneously in the most opposite and distant points.

"The following table exhibits the number of cases that were reported from the different districts, with the ratio to the population.

	Population.	Cases.	Ratio of Cases to Population.
City, ...	80,458 . .	407 . .	. 1 in 197 7-8
Kensington, . . .	13,320 . .	111 . .	. 1 in 120.
Northern Liberties,	28,932 . .	144 . .	. 1 in 200 11-12
Penn Township, .	11,141 . .	55 . .	. 1 in 202 3-7
Southwark, . . .	20,740 . .	251 . .	. 1 in 82 4-28
Moyamensing . .	6,822 . .	198 . .	. 1 in 39 5-11

"From the above table it appears that the epidemic prevailed with greatest severity in Moyamensing and Southwark. This is to be attributed to the character of the population, rather than to local causes. In both these districts reside the worst portion of our population, and in Moyamensing, especially, there is a dense population, some of whom are of the lowest order and most abandoned habits.

"In the city, though the cases as occurring in different parts, were not kept distinct in the reports, yet it was well known that the larger proportion of them took place in the external limits, especially the western borders, towards the Schuylkill, and the southern extremity, while a very small number only were developed in the central portion.

"The chief mortality of the disease existed in the public institutions. It was much lighter in private practice. The following table exhibits the cases of deaths, as reported in private practice, and the public institutions. The reports, however, do not exhibit the results of private practice in as favourable a light as they really were. A considerable number of physicians in the more respectable practice, reported only the cases that proved fatal or exceedingly severe. They did not return to the Board of Health the lighter cases, which yielded to the operation of remedial measures. The mortality of private practice in the reports, appears, in consequence, to have been far greater than it really was.

"*Table of Cases and Deaths, with the Ratio as occurring in Private Practice, and the Public Institutions.*

	Cases.	Deaths.	Ratio of Deaths to Cases.
Private practice, . . .	1175 . .	270 . .	1 to 4 3-16
Hospitals, ...	874 . .	342 . .	1 to 2 5-9
Alms-house, ...	174 . .	92 . .	1 to 1 41-46
Arch street Prison, . .	86 . .	46 . .	1 to 1 20-23

"Had the returns of cases in private practice been complete, the proportion of cases would have been much greater, it would have ranged probably as 1 to 70 or 80, or even more.

"In the hospital practice, the first cases introduced were nearly all fatal. This circumstance is to be accounted for from the universal observation, wherever cholera has prevailed epidemically, that the worst constitutions were the first to suffer attacks. In the commencement of the epidemic, persons first attacked, unaware of their danger, and the nature of the affection, neglect application for aid, and resist the offer of hospital assistance until reduced to a hopeless condition. Besides, misled by the authority of the English and Scotch writers, extensive means had been prepared for warming the patients by heated air, steam, and other means. Experience in a short time proved the pernicious effects of this system. The patients succumbed most rapidly under the exhaustion induced by the profuse watery exhalation from the skin caused by this treatment.

"The disease first appeared in the Alms-house, July 29th; it reached its period of greatest activity on the 8th and 9th of August, gradually declined, and terminated on the 25th of August.

"In the Arch street prison are confined vagrants, disorderly persons, criminals guilty of petty larceny, most of them the victims of low and brutal debauchery, and a limited number of debtors.

"The disease manifested itself on the 31st of July. Cases continued to occur daily, but on the 5th of August the number of cases and deaths suddenly augmented, producing a scene of almost unexampled desolation. In the same room were mingled the dead, the dying, the sick, and the well. The prisoners became frantic with despair, and threatened the lives of the officers and attendants. A number of medical gentlemen, the inspectors and others, repaired to the prison to alleviate the sufferings of these unhappy beings. The vagrants were discharged, the sick were conveyed to the hospitals, and all the prisoners whom it was possible to release were dismissed. The confusion was so great, that a return of the cases and deaths was not made to the Board of Health on that day. By reference to the meteorological table, it will be seen that on the 5th August, the day the disease in the prison acquired its sudden intensity, the barometer had fallen lower than it had been for a month previous, the maximum of the thermometer was at the highest point for the month, and the dew point at the highest elevation. The atmosphere in consequence was light, moist, and oppressive to the feelings. Was this meteorological state of the atmosphere, and the sudden augmentation of the disease, mere coincidence, or were they connected?

"The mortality of the disease in relation to sexes, is shown in the following table. The relation as to cases cannot be ascertained.

"Number of deaths from commencement of cholera to September 1st, per weekly reports of interments, was—

Deaths, 909.	Males, 539.	Females, 370.
Under 20 years.	do. 70.	do. 48.

"*Table of Deaths from Cholera, arranged as to Periods of Life; showing also the Ratio of Deaths from Cholera to the Periods of Life.*

Ages.		Deaths.	Ratio.
Under 1 year		4	1 in 604
Between 1 and 2 years		4	1 503
2	5	30	1 912
5	10	39	1 919
10	15	19	1 188
15	20	22	1 96
20	30	179	1 81
30	40	228	1 60
40	50	159	1 46
40	60	100	1 28
60	70	71	1 102
70	80	47	1 212
80	90	5	1 36
90	100	1	
100	110	1	
		909	

"From this table it results that the earlier periods of life give the greatest exemption from the attacks of the disease, especially the ages from 2 years to 10 years; and that the period of life most prone to be affected, is from 40 to 60 years, and more particularly from 50 to 60 years.

"The ravages of the disease were more extensive in the coloured than in the white portion of the population, in proportion to numbers. The fact is shown in the following:—

"*White Population.*

Nineteen hundred and seventy-seven cases.
Ratio of cases to white population—1 to 74.

"*Coloured Population.*

Three hundred and thirty-eight cases.
Ratio of cases to black population—1 to 41.
Ratio of blacks to white population—1 to 11 4-7.
Ratio of cases of blacks to whole number of cases—1 to 6.

"It has been a common observation by writers on epidemic diseases, that during the prevalence of an epidemic, it appeared to subdue and suppress all other diseases, monopolising to itself, for a time, all the energies of destruction. This observation has been repeated since the days of Sydenham, by whom it was announced,

though it has not been supported by statistical evidence.[1] In the present epidemic, although its influence was so extensively felt in the city, the observation has not been sustained. The following table shows very clearly, that during the prevalence of the late epidemic, other diseases continued, not only unabated, but actually augmented, causing an increase of mortality independent of that produced by cholera. During the months of June, July, and August of this year, the deaths from the diseases generally prevalent, exceeded those of the corresponding months of last year, 425. It is to be remarked, however, that the diseases in which the augmentation of the mortality was the greatest, are those congenerous with cholera, viz. gastric, enteritic, febrile diseases, and inflammations. All those diseases appear to have derived an increase from its presence. It is also to be observed, that scarlet fever, instead of yielding to the sway of cholera, was actually augmented.

"*Table*[2] *showing the prevailing Diseases independent of Cholera; what influence it exerted over them; and the rate of their Mortality.*

DISEASES.	1831.				1832.			
	June.	July.	Aug.	Totals	June.	July.	Aug.	Totals.
Consumption,	35	41	33	109	44	52	73	169
Convulsions,	18	26	29	73	28	29	39	90
Cholera Infantum	45	132	82	259	25	134	157	316
Diarrhœa and dysentery,	18	28	49	95	15	47	83	145
Fevers,	17	24	35	76	31	35	65	131
Scarlet fever,	5	2	10	24	23	17	14	54
Inflammations in general,	32	19	26	77	28	43	29	100
Inflammations in the chest,	16	10	8	34	16	15	7	38
Inflammations in the abdomen,	16	9	18	43	12	28	22	62
Dropsy in the head,	22	22	29	73	5	33	23	61
Do. in the chest,	2	4	6	12	2	4	3	9
Do. in general,	6	12	11	29	3	10	9	22
Debility and decay,	28	33	29	90	16	45	8	89
Apoplexy,	9	8	4	21	4	8	7	19
All diseases, (still born deducted,)	294	467	490	1251	369	785	1431	2585
All diseases, (malignant cholera deducted,)	294	467	490	1251	369	689	618	1676
Excess in mortality of 1832,					75	318	941	1334
Excess after deducting mortality from cholera,					75	222	428	425"

[1] This opinion is also supported by Villermè, who says, that during the cholera epidemic in Paris, other diseases became more rare. I prefer Dr. Jackson's view of the case, as agreeing with my own experience during the cholera epidemic in Dublin in 1832 and 1834.

[2] "For this table I am indebted to Dr. Emerson."

Why the cholera, *if an imported disease*, should have broken out nearly simultaneously in Quebec and Montreal, is very easily accounted for, since both are the receptacles of British and other foreign emigrants; and on the same principle, we must explain its appearance so soon after at New York, where, no doubt, it arrived by a separate importation from Europe, a circumstance which will prevent us from feeling the same surprise with Dr. Jackson, that between Quebec and New York *all the intermediate cities on the seaboard escaped*, at least for a few months. This is analogous to the exemption of Waterford and Wexford during several months that cholera raged in Dublin and Cork. I have published Dr. Jackson's Report unabbreviated, because it is intended to be conclusive against the theory of contagion; while it, in my opinion, contains strong internal evidence of a contrary tendency. The great number of cases which occurred in the Alms-house and Arch street prison, seems to me to furnish a conclusive argument in favour of its contagiousness; and Dr. Jackson admits that it arose among the lower orders of emigrants both in New York and Philadelphia; but as I do not wish to entangle myself in a protracted discussion of this question, I shall now resume the account of the progress of cholera. In the United States it spread far and near, as might be expected from the wonderfully rapid and frequent intercourse that takes place all over the Union; but except in the condensed population of the chief seaports, its ravages were not great. It is curious to observe how little Philadelphia suffered in comparison with Montreal, Quebec, or New York; no doubt because its population is less condensed, and live in families more separated from each other. In making this observation, I do not mean to undervalue the power of predisposing causes, such as poverty, bad diet, intemperance, &c., which prevail more in the latter cities than Philadelphia. Still, comparing America with those European and Asiatic countries which suffered most, the only constant difference we can discover is, that the separation of families is much more complete in the United States than in any other country except England; and to this difference, consequently, we are justified in referring for an explanation of the remarkable fact, that England and the United States fared better than other countries, notwithstanding their acknowledged superiority, above all in the facilities of internal communication. A wish to be brief forces me to conclude the subject of the cholera in North America, with the following list of places, and the dates of its arrival in each.

Albany, ...	3d July, 1832.
Troy, ...	16th July, „
New Brunswick, . . .	July, „
Rochester, ...	July, „
Baltimore, ...	August, „
Washington, ...	August, „
Boston, ...	August,[1] „

[1] I am not certain of the dates of its first appearance where the day of

Cholera did not reach South America at all, a fact explicable by the great length of the voyage from the infected countries, which reason also protected the Cape of Good Hope, the West Indies, and New Holland. It is a curious fact, that New Holland, for the same reason, has hitherto been free from measles, scarlatina, and hooping-cough, although the colony is fifty years old. We must now return to Europe; and first with respect to Portugal. It appears from the following editorial paragraph in the Medical Gazette,[1] that the disease was imported. "The London Merchant Steamer sailed from England for Oporto, on the 25th December, 1832, and arrived at the mouth of the Douro on the 1st January, 1833, having lost seven persons on her passage by cholera. The troops which she took out, with General Solignac, landed immediately at Foz, about two miles to the west of Oporto. By a letter from a medical gentleman of that city, which we have lately seen, it appears that cases of the disease occurred at Foz, on the road to, and in Oporto, before the 15th of January; and we know from other authorities, that it has since spread to *Coimbra* on the south, and *Vigo* on the north."

Mr. Lardner, a very intelligent surgeon, and formerly a pupil of mine, has written a very interesting paper on the progress of cholera in Portugal.—Lancet, 1834-5, p. 314. He is a decided non-contagionist, but his facts seem to me to be strongly corroborative of the doctrine of contagion. Among other admissions, the following is almost conclusive. "Lisbon was not visited by cholera for a considerable time after Aveiro; which fact may give the contagionist a lift, for during the siege there existed no direct communication by water between Oporto and Lisbon. The Miguelite batteries would not allow a ship to enter the Tagus, and Donna Maria's ships kept a strict blockade outside the bar." The epidemic took six months to travel slowly by land from Oporto to Lisbon. Had the communication by sea between those two ports been open, no doubt it would have reached Lisbon sooner: in America how quickly it extended from one seaport to another. It is a remarkable circumstance, and one which ought to have great weight in the discussion respecting the contagiousness of cholera, that *cholera has in no recorded instance appeared in any place sooner than the ordinary modes of communication might have brought it from some infected station.* Again, it can easily be proved that *the rate at which cholera travels varies with the rapidity of that communication.* A few weeks were sufficient to transport it from the ports of Britain more than three thousand miles across the Atlantic to Canada, while it took six months to creep along the interrupted line of communication between Oporto and Lisbon. The following dates refer to Portugal, Spain, and Italy. I regret that I have not ascertained more numerous and accurate *data* respecting its pro-

commencement is not mentioned; but in all the above places the cholera prevailed during the above months.

[1] Vol. xii. p. 123.

gress in these countries, but what I have been able (in my hurry) to lay my hands on, will perhaps prove sufficient for my present purpose, which is only to map out the route and march of the main body of the disease. From the preceding observations it will appear, 1st, that cholera has had no fixed rate of progress; 2d, that it has spread in every direction, sometimes traveling northwards, sometimes southwards, at other times east or west, its route being determined not by the points of the compass, but by the great lines of internal and international communication.

Oporto, ...	3d January, 1833.
Aveiro, . . .	3d February, "
Coimbra, . . .	March, "
Vigo, ...	March, "
Lisbon, ...	15th June, "
Havana, . . .	26th Feb., "
Drammen, (Norway,) .	1832. "
Christiana, . . .	29th September, 1833.

Cholera never got to any other West Indian islands, nor to British (fomerly Dutch) Guiana, Demerara, nor any of the embouchures of the great South American rivers, Amazon, Orinoco, or La Plata—[Dr. Gilgeous]—though the soil and climate, with the immense tracts of inundated and swampy lands, would there seem most favourable to its developement.

Cholera spread extensively in France in summer:—

Marseilles, ...	Spring, 1835.
Toulon, ...	Ditto, "
Mexico, (frightful,) . .	Summer, July, 1832.

In September, 1835, (Lancet, vol. for 1834-5, p. 782,) "the cholera had nearly ceased its ravages in the south of France, and took a south and easterly direction along the countries bordering the Mediterranean Sea. It has penetrated into Piedmont in spite of the strictest precautions, and now prevails with more or less intensity at Nice, Coni, Livorno, Genoa, Florence." From this extract we do not learn the dates of its arrival at the above places, but they were probably according to their respective distances from France. The kingdom of Naples was not infected until a still later period: at Naples, probably, September, 1836. It attained the maximum at Naples on the 22d November, 1836; Algiers, 14th October, 1837; Bona, September, 1837.

To trace it accurately, its secondary routes and dates of reappearance should be made out; it would then be found to have returned often on its steps.

Thus in September, 1837, Marseilles was attacked for the third time, while in same season of the year 1837, it reappeared also at Berlin, Prague, and Danzig.

It is worthy of remark, that cholera began at Naples, which carries on a perpetual commercial intercourse with Marseilles, about

a year before it commenced in Rome! August, 1837. The disease travelled southwards in the north of Italy, setting out from France; northwards in the south of Italy, starting from Naples.

An interesting question here arises, whether cholera is likey to become a permanent resident in this country. Its history indicates that it will not; for although cases of Asiatic cholera are now and then met with, they are by no means so violent or intense as formerly; and their comparative unfrequency may be judged from the fact, that but 460 deaths from cholera took place in England and Wales during the six last months of 1837, while other diseases formerly introduced from abroad, but which have become thoroughly naturalised in Great Britain, present a very different result. Thus in the half year the deaths from

Small-pox were	5,811.
Measles	4,732.
Scarlatina	2,520.

Sir James Clark, physician to her majesty, has interested himself much in obtaining information for me respecting the progress of cholera in Great Britain; and has on this occasion, as on many others, displayed a most praiseworthy zeal for the promotion of medical science. To him I am indebted for maps of Scotland, England, and Ireland, constructed specially for my use, and in them are marked, with the greatest accuracy, all the places where cholera appeared. These maps I had intended to publish, but found that the expense would be very considerable, and far beyond what could be borne by a periodical; as a substitute for the maps, I have composed a list of every city, town, or village attacked by cholera, in Great Britain; and have arranged the names in counties beginning in the north of each kingdom, and setting down the counties, as we proceed southwards, in an order arranged (in each successive set) from west to east. This list will enable any of our readers to construct the maps for himself with great ease and accuracy. The numbers in the list refer, I believe, to the order of succession in which the disease arrived at each place respectively. If this be so, the value of the table will be still greater. Sir James Clark has most kindly promised to procure the precise dates for every place as soon as possible, and I shall not fail to publish them in the March number of this Journal.

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Berwick, . . 172
Tweedmouth, . . 195
Coldstream, . . 18
Kirknewton, . . 204
Dumfries.
Moffat, . . . 200

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The maps from which the preceding tables have been constructed furnish, even on a cursory examination, some very interesting particulars. In Scotland nine tenths of the extensive regions north of the Clyde, and popularly termed the Highlands, escaped, and the parts which were visited form two leading groups, the smaller situated at either side of the eastern embouchure of the Caledonian canal; the larger including the country immediately north of the line joining the Firth of Forth and Firth of Clyde.

Now there is here an evident connection between the visitation and the chief routes of commerce and communication, a fact rendered still more striking by the total immunity from cholera which the whole of the western Highlands enjoyed, there being no infected locality between Inverary and Cape Wrath. Again, the Mull of Cantire escaped, with the exception of Campbelton, a seaport possessing a frequent steam communication with Glasgow. In the Lowlands, the greatest number of infected places occurred in the vicinity of the great line of communication connecting Edinburgh, Glasgow, and Greenock, and near the English borders, particularly towards the eastern extremity, not far distant from the county in which cholera first appeared in England. A very striking circumstance is the freedom from cholera enjoyed by the Western Isles, (Hebrides,) and all the western ports of Scotland, while so many of the eastern ports were affected. Here the exemption cannot be attributed to any comparative salubrity of climate, and freedom from low swampy tracts of country, and river courses, but to the manifest facility which the coast trade on the eastern side of the Caledonian peninsula afforded to the transmission of the disease. Many similar deductions might be made from an examination of the map of cholera in England and Ireland, but want of space prevents me from entering into further particulars.

I cannot conclude, however, without noticing the curious and remarkable fact, that the country, which of all others most abounds in swamps and pestilential miasmata, I mean the western coast of Africa, escaped the visitation of cholera altogether; not a single

town on the Atlantic shore of Africa was visited. Sierra Leone, and all the low, half-inundated but thickly inhabited countries in the embouchures and deltas of the Gambia, the Niger, and the Zaire, escaped. Contrast this immunity with the ravages the cholera made in all the Mediterranean seaports of Africa, where the soil is comparatively dry and sandy, and the inference is obvious.

THE END.

ON

DISEASES OF THE RECTUM.

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PREFACE.

The diseases of the rectum are very frequent in their occurrence, and derive additional interest, from the distressing symptoms which they occasion, as well as the relief of which they admit from the resources of surgical art. It may be added, that the mystery and concealment connected with their situation not only favour the deceptions of empirical practitioners, but also encourage the proceedings of wrong-headed operators, who prefer the most painful and dangerous means of treatment to those which are easy and safe.

On these accounts, it is desirable that this department of surgery should be thoroughly understood by the members of the profession, and that its leading principles should be placed prominently before them. The diseases of the rectum have accordingly been made the subject of many treatises, expressly devoted to their consideration, and it may seem unnecessary for me to increase the number of these productions. But the progress of modern pathology and surgical practice has introduced many improvements that have not yet been fairly brought together, and explained in their application to the management of those complaints which are at present more particularly in view. I have attempted to supply this defect; and, by a plain statement of the seat, nature, symptoms, and treatment of the different affections which are met with at the extremity of the rectum, endeavoured to assist practitioners in discharging their duty to the patient, and to protect patients against unprincipled or reckless practitioners.

It was not my wish to criticise the writers who have preceded me; and I have not done so, except on one or two occasions, where it seemed necessary, in order to explain my own meaning. From unwillingness to extend the limits of the treatise, I have not related detailed cases; but I may assure the reader that there is nothing stated which does not rest upon my own observation.

9, *Charlotte square, November*, 1837.

CHAPTER I.

FISTULA IN ANO.

It is not easy to perceive how the disease named *fistula in ano* has become so well known to the public, and why the slight incision required for its remedy is performed in the theatre of the hospital with all the pomp and circumstance of a great operation. The

mere frequency of the complaint, and the unpleasant nature of its symptoms, are not sufficient to account for this; while its hidden seat, and the disagreeable feelings connected with it, so far from favouring exposure, must tend to conceal the knowledge of its existence, as well as the means employed for its treatment. In these circumstances, the interest taken in fistula, both by the profession and by the public, can be ascribed only to the well ascertained fact, that the disease does not admit of remedy except from an operation, which was formerly one of great severity, and even considerable danger.

Louis XIV. suffered from *fistula in ano*, and, being naturally unwilling to undergo the operation which his medical attendants assured him was necessary, listened to various proposals for curing the disease without having recourse to the knife. Instead of trying these methods on his own person, however, he collected a great number of his subjects who laboured under the same infirmity, and caused the proposed experiments to be tried on them. Some of them he despatched to the waters of Bareges, others to those of Bourbon, and many more he shut up in rooms, provided with every thing that could be suggested for the purpose in view. At the end of a year, finding that not a single patient had been cured, his majesty yielded to necessity, and permitted his surgeon, M. Felix, to perform all the incisions which he judged proper.

We have here a striking illustration of the necessity of the operation; and the importance attributed to its performance, as formerly practised, may be estimated from the number of medical men who were present on this occasion, together with the amount of their remuneration. Besides the surgeon and assistant-surgeon, there were two physicians, four apothecaries, and an apprentice, and the sum total of their fees was £14,700.[1]

The inefficacy of all remedial measures, except the knife, for curing fistula, still remains unquestioned, unless by inaccurate observers or unprincipled empirics; but the extent to which it must be employed, is now happily ascertained to be greatly less than was formerly supposed, and, through progressive improvement, it has been at length circumscribed within such narrow limits as hardly to deserve the serious title of an operation. In order to trace the steps which led to this important result, and to understand the true principles of treatment which have been finally established, we must consider the origin of fistula, the causes that give rise to it, the symptoms attending it, and the circumstances which impede its spontaneous cure.

In the first place, a collection of matter is formed under the integuments of the hip near the anus, and usually to one side of it. This deposition sometimes occurs quickly, with heat, redness, and

[1] M. Felix, 50,000 crowns = £6000; Dr. Daquin, 100,000 livres = £4000; Dr. Fagon, 24,000 do. = £1000; M. Bessiere, 40,000 do. = £1500; four apothecaries, (each 12,000 do. = £500) £2000; M. Raye, (apprentice to M. Felix,) 400 pistoles = £200.—*Dionis, Course of Surgical Operations*, p. 228.

pain of the part; at other times, slowly and insidiously, without any sign of inflammatory action, so that the first circumstance which attracts attention is a flat and ill-defined swelling that results from the presence of the fluid, together with thickening of the adjacent cellular substance. In which ever of these ways the abscess is formed—and every variety is met with, from the rapidity of a few hours to the slowness of as many months—the matter, if left to itself, sooner or later, by inducing absorption of the neighbouring textures, makes a way for itself to the surface. But as it is situated between the skin of the hip and the mucous coat of the rectum, it may effect evacuation through either the one or the other of these coverings. In conformity, however, with the general law as to progressive absorption, occasioned by the pressure of matters foreign to the healthy constitution of the body, it most frequently escapes by an aperture through the external integument. This opening is usually very small, often hardly perceptible, and if the cavity be examined after its contents have been discharged, the mucous membrane will be found almost completely denuded, to a small part of its extent, at the distance of an inch or a little more from the anus. As the matter to get into this situation would, if originally deposited externally to the sphincter, have to penetrate between the muscular fibres, its formation probably takes place in the vicinity of the inner coat of the bowel, whence it proceeds outwards, overcoming the obstacles opposed to its progress in this direction, instead of pursuing an inward course, in opposition to the general tendency, which leads to the external surface of the body.

If the patient has been previously in pain, he feels comparatively well after the matter is evacuated, and may suppose that he is to recover without any farther trouble. But the cavity of the abscess, though it contracts, does not become obliterated; the discharge continues of a thin and watery consistence; and the orifice acquires a still greater degree of straightness, at the same time generally projecting from the surface of the skin in the form of a small pimple-like protuberance, at the summit of which it is situated. This appearance is owing to an effusion of organisable matter round the opening, in consequence of the continued irritation which is caused by the discharge passing through it. From the same cause, the sides of the sinus acquire an increase of thickness and density so as to assume the condition which, in surgical language, is designated fistulous. If the disease be still permitted to pursue its course unchecked, a small aperture is sooner or later generally formed also through the thin denuded part of the mucous membrane of the rectum. It may seem surprising that this second opening should be formed after the matter has procured vent elsewhere; but there can be no doubt as to the fact, and it agrees completely with what is observed to happen in the case of abscesses situated in the neighbourhood of the urethra, which, after their evacuation, whether spontaneous or artificial, often discharge purulent matter alone for a time, and then urine also.

It happens sometimes, but very rarely, that an aperture is formed in the first instance through the mucous lining of the gut. This constitutes what has been called a Blind Internal Fistula. The other two conditions that have been mentioned, are named the Blind External, and the Complete Fistula. The history of the case, especially the existence of pain and tension in the vicinity of the anus subsiding after a discharge of matter from the bowel, the continuance of such a discharge, and the presence of a flat induration in the hip, with softness and depression in its centre, are the signs which lead to the detection of this form of the complaint. However long the fistula may be permitted to continue, no more than one internal opening is formed; but through the occurrence of successive abscesses, the external apertures are occasionally multiplied, and sinuses extend into the hip as well as the perinæum.

Causes of Fistula in Ano.—The process which has been described as leading to the formation of *fistula in ano*, occurs in both sexes, and at every time of life, but is out of all proportion more frequent in males than females, and is comparatively rare before twenty or after sixty years of age. I have operated repeatedly on children for this disease, and more than once on infants only a few months old; but, so far as I can recollect, in one instance only beyond the age of seventy.

The circumstances which occasion the disease, act either by exciting a predisposing liability to it, or by directly calling it into existence. Of the former, may be particularly mentioned chronic derangement of the lungs and digestive organs, especially the lower part of the intestinal canal. And of the latter, the most important are constipation of the bowels, sedentary occupations, and exposure to cold. It is difficult to trace the connection between pulmonary complaints and *fistula in ano;* but no point in pathology is better established than that there is such a connection; and attention is not unfrequently first drawn to the phthisical condition of a patient, by the disposition that he shows to suffer from the disease in question; whence it has sometimes been erroneously supposed that the discharge of the fistula brings on the disease of the lungs. As the great intestine is generally found ulcerated in the bodies of those who have died from consumption, it seems probable that the morbid state of this part, and not that of the lungs, is the exciting cause of fistula; but the disease certainly does occur in cases of pectoral affection which exhibit no symptom of intestinal disorder. Most frequently the cause of the disease cannot be precisely ascertained, and the patient is often not aware of its presence until he happens to notice the discharge of matter which proceeds from it. Among the causes of fistula, are sometimes reckoned disease of the bones of the neighbourhood, as caries of the sacrum, or exfoliation of the denser osseous texture, which composes the arch of the pubes. But the fistulous orifices in the vicinity of the anus, originating from this source, are not properly classed with a disease which exists independently of any other

local cause than its own peculiarity of position. They cannot be remedied by the same means as *fistula in ano*, and, if remediable at all, require different treatment.

Symptoms of Fistula in Ano.—Uneasiness about the anus, with a more or less copious discharge of thin purulent matter, staining the linen, and otherwise annoying the patient, are the most constant symptoms of the complaint. The occasional escape of flatus and mucous fluid from the rectum, are generally superadded in the case of a complete fistula. But the passage of feculent matters through the preternatural channel, though often mentioned as a part of the inconvenience experienced, does not usually take place; and, indeed, is never met with, except when the disposition to the disease is very strong, as in confirmed phthisis, in which case the aperture of the fistula, external as well as internal, instead of being small and circumscribed by effusion of organisable lymph, is large and flabby. Besides the exudation from the fistula, and more or less uneasiness about the part, especially in going to stool, people of much sensibility are farther distressed by a feeling of weakness and imperfection, which renders their existence almost intolerable. There are other persons of a less sensitive constitution, who, giving themselves no concern about the disease beyond its obvious effects, are able for a long while to endure the discomfort which it occasions. As an instance of this, I may mention the case of a gentleman, between fifty and sixty, on whom I operated for a complete fistula with two external openings, which had existed for thirty-five years. As has been already observed, the orifice of the sinus is usually very small, and, though generally rendered more manifest by being elevated above the surrounding surface, it still not unfrequently escapes the notice of the patient, who supposes that the discharge issues from the anus. Even the surgeon sometimes experiences difficulty in detecting the disease from this source of obscurity; and I once operated upon a gentleman for a complete fistula, after he had been assured by an eminent physician, who carefully examined him, that there was no morbid affection whatever in the neighbourhood of the rectum. The fluid which is discharged, varies both in quantity and quality, being at one time thin and watery, at another, thick and purulent. It is often so scanty and limpid, that obliteration of the cavity seems about to be accomplished. But sooner or later the flow is increased; perhaps a new abscess forms, leaving another orifice; at all events, the fistula remains as obstinate as ever, having no limit to its existence except an operation.

When the fistula opens into the gut, more or less flatus and mucus must pass through it, owing to the resistance which the sphincter muscle opposes to their exit by the anus, and thus adhesion or contraction in the surface of the sinus will be effectually prevented. But when the fistula is not complete, the reason why it should not heal like a sinus in any other part of the body is less apparent. The mere laxity of the texture, or any other peculiarity in the nature of the part concerned, is not sufficient to

account for this, since suppurating cavities in the neighbourhood of the rectum are known to heal very kindly and readily—as, for instance, that which results from the operation of lithotomy. When the sinus, as it almost always does, penetrates between the fibres of the sphincter, the obstinacy in question may be ascribed to the frequent motion and separation of the sides of the cavity, which must result from the action of the muscle. But even this obstacle to recovery is not always present, since the fistula sometimes lies quite superficially under the skin and mucous membrane, without passing through the muscular fibres at all. In such cases, it seems most probable that the detached and denuded state of the mucous coat of the gut impedes the healing action.

Treatment of Fistula in Ano.—It appears from the records of surgery, that the treatment of *fistula in ano*, until within the last hundred years, was extremely complicated and severe. The induration surrounding the walls of the sinus being attributed to a peculiar morbid action resident in the part, it seemed to admit of no remedy except by destruction or removal; and the cavity itself was thought to require complete division of the gut, throughout the whole of its extent affected, with subsequent dressings of the most careful kind. In conformity with these principles, we find that after the patient had been prepared by bleeding, purging, and regulated diet, corrosive sublimate, or other powerful escharotics, were introduced into the fistula, so as to bring away a slough in the form of a cylinder; that pieces of gentian root, or sponge tent, were next inserted to dilate the cavity, and, by thinning the partition between it and the gut, facilitate the third step of the operation, which consisted in dividing the septum to its farthest extent; and that, until the cure was completed, various carefully medicated dressings were daily introduced. Such being the established principles of practice, different practitioners followed out the objects which they kept in view by a variety of methods. Some, instead of the slow and uncertain action of caustic, employed a knife for removing the callosities, either scooping them out at once, or cutting freely through them in several directions, so as to inflict what was deemed sufficient injury to insure their destruction by sloughing or suppuration. Some divided the septum between the gut and sinus by means of knives, or scissors, or apparatus contrived for the purpose, such as what was called the probe-razor; and others thought it better to transfix the gut with a needle, so as to include the partition in a ligature of thread, or lead wire.

The treatment thus conducted was not only tedious and painful, but often attended with alarming consequences. Inflammation and constitutional disturbance were apt to follow, and the extensive incisions practised for the removal of callosities, or dividing the septum of a deeply penetrating sinus, frequently occasioned very formidable hemorrhage, as well from its amount as the difficulty of arresting it. The cure, moreover, was not always complete, a discharge of matter occasionally still continuing, in consequence of the deep wound not healing at the bottom; and we have

the testimony of many authors who wrote at the period referred to, that the effect of freely cutting out the diseased parts was frequently so injurious, or rather destructive to the sphincter, as to occasion constipation, and what was equally distressing, though at first sight hardly compatible with it, incontinence of the bowels, their solid contents being retained, and the fluid involuntarily expelled. It is no wonder, then, that *fistula in ano* came to be regarded as a complaint meriting the most serious apprehension of the patient.

In 1765, Mr. Pott published an excellent treatise on the disease, in which he reprobated the practice of destroying the callosities by caustic, and cutting them out with the knife, which proceedings he considered equally unnecessary and hurtful. He pointed out that the cavity of the abscess, and consequently that of the fistula, resulted not from a loss of substance in the part, but merely from distension of the texture, in which suppuration took place; and that the callosities or surrounding induration proceeded not from any new formation, but from induration of the cellular and adipose textures bounding the cavity. On these grounds, he maintained that, in order to effect a cure, it was not necessary either to take any thing away, or to use means for promoting the growth of new substance; that all really required was to relieve the parts concerned from the continued irritation, which caused and kept up the callous thickening; and that this object could be attained most certainly by simply dividing the septum, "so as to lay the cavities of the gut and abscess into one," abstaining from all escharotic or irritating applications, and using the mildest dressings. For performing the operation, he recommended a blunt-pointed curved bistoury, as the easiest and most manageable instrument.

The soundness of Mr. Pott's principles, the forcible language in which they were expressed, and the authority derived from the public field where he exhibited their practical application, produced a strong impression on his professional brethren, and the treatment of fistula has ever since been in a great measure free from the objectionable practices formerly in use. As was to be expected, however, many practitioners clung to the methods in which they had been educated; and even in the present day there are some who, whether from imbibing the bad example thus transmitted to them, or from an unhappy peculiarity of judgment, still prefer the old and unjustifiable process of excision. Fifteen years ago, I saw an eminent professor of surgery in Paris cut out the fistula; and I understand that he continues to pursue this practice. About eight years ago, a middle-aged woman came under my care in the Surgical Hospital, on account of a recto-vaginal fistula, and stated that her complaint commenced with a *fistula in ano*, for which she had had an operation performed by the surgeon of a provincial hospital, who cut something out, and laid it on the table, since which there had been a communication between the rectum and vagina. Last year, a gentleman from the north of England applied to me on account of some unpleasant consequences result-

ing from an operation, or rather series of operations, to which he had been subjected, on account of *fistula in ano*. His principal complaint was inability to retain the contents of his rectum, which, notwithstanding the resistance of a carefully constructed bandage, were wont to be suddenly and involuntarily discharged, so as to cause great discomfort, and constant apprehension. Though prepared to find something far wrong, I was not less surprised than shocked, upon inspecting the seat of the disease, to see no appearance of the anus, but instead of it a deep excavation, at the bottom of which the mucous coat of the bowel presented itself to view, completely divested of the sphincter. From these and other facts of the same kind that might be mentioned, I fear it must be concluded, that the plan of excision is still not entirely abandoned; but, feeling assured that those who persist in adhering to it, notwithstanding all that has been said and written on the subject, would not have their views altered by any argument in my power to use, I shall leave them to follow the progress of improvement at their own leisure, and shall proceed to explain some important steps that have been established in advance of Mr. Pott's practice.

It had been noticed by Sabatier, and other good surgeons, that the internal opening of a complete fistula was generally seated near the orifice of the anus. But in 1820, M. Ribes had the merit of showing[1] that it was always so situated, never exceeding the distance of an inch and a quarter, and often lying considerably nearer the skin. The importance of this observation will appear, when it is recollected that the operation requires division of the parts intervening between the two openings of the fistula; since, unless the internal one be sought for in the proper place, it may escape detection, and thus not only occasion an unnecessarily high section of the septum, but, from not being included in the incision, lead to a continuance of the disease. When the internal opening is sought for at the summit of the sinus, it cannot be found, so that the fistula is apt to be supposed incomplete or blind external; and M. Ribes, avoiding this error, ascertained that an internal aperture existed much more frequently than had formerly been supposed. He went, indeed, into the opposite extreme, contending that it was present in every case requiring the operation, and accounting for its constancy by attributing the origin of the disease to ulceration of the mucous coat of the gut. But I have already stated that the abscess which gives rise to fistula is very generally discharged outwards in the first instance; and every attentive practitioner must have remarked that an internal orifice is very seldom met with in recently formed fistulas; which facts are quite inconsistent with this theory of M. Ribes.

I have ascertained farther, that, in those cases where an internal aperture does not exist, the mucous membrane at the part in which it would be situated if present, is not only denuded, but rendered so thin that the perception of a probe through it is hardly less distinct

[1] Quarterly Journal of Foreign Medicine and Surgery. 1820.

than if it had entered the rectum; and that, if the incision extends to this point, the cure will be no less certain than if an opening into the gut had existed.

In regard to the importance of the principles thus established, I may, in the first place, remark, that limiting the incision within the narrow bounds that have now been mentioned, lessens not only the difficulty of its performance, and the suffering of the patient, but also the risk of hemorrhage, and the trouble of after treatment; since, instead of having to keep separate the edges of a deep and not easily accessible wound, the surgeon has merely to prevent adhesion between the lips of a superficial cut. But the operation, while thus simplified in its performance, is also rendered more certain in its effect, since in cases of complete fistula the most extensive incisions will fail to afford permanent relief, unless they include the internal opening. I have very frequently operated on complete fistulas that had been looked upon as blind external, from the internal orifice having escaped detection through unacquaintance with its position; and the repetition of operations for the disease, which are so frequently heard of in practice, are no doubt referable to this mistake.

In the reports of surgical cases which I have published from time to time since the year 1829, and also in the systematic work on surgery, of which the first edition appeared in 1831, I have endeavoured to explain and impress these principles, which have been uniformly acted upon in my own practice. They are still, however, far from being generally adopted, and many writers of the highest authority continue to inculcate the practice of Mr. Pott. Sir A. Cooper says,[1] "if the fistula does not open into the intestine, you must pass the instrument (a bistoury) up the sinus till it reaches the extremity."—"A very copious hemorrhage generally follows the division of the septum," &c. Mr. Copeland says, "In this operation, though there are no vessels of very considerable size in danger of being wounded, yet, when the sinus extends far up the side of the gut, a hemorrhage now and then takes place, either at the time of the operation, but more usually a few hours after it, which, if it be not important from the magnitude of the divided artery, becomes often so from the difficulty, perhaps impossibility, of securing it by a needle and ligature."—"I will venture to say, that it (the hemorrhage) has occurred to almost every surgeon who is in the habit of performing the operation."—"After many unsuccessful attempts to secure a bleeding vessel under such circumstances, I once accomplished it by introducing a blunt gorget into the rectum; and, by keeping the gut thus dilated, I was enabled to see the orifice of the bleeding artery, and to secure it."[2] Mr. Liston says, "Some con-

[1] Surgical Lectures, p. 425. 1837.

[2] The bad effects of dividing the septum to its farthest extent are well illustrated by the following case which Mr. Copeland has given:—

"A carpenter, about thirty years of age, had the operation for *fistula in ano* performed on him in the year 1803. There were two extensive sinuses in the nates divided; but the principal one extended above three inches up

tend that fistulæ are always complete, that they commence from within, and that the internal opening is always at one particular point; but such, according to my experience, is very far from being the case."—"Having reached the extreme depth of the canal, the direction of the instrument's point is changed, so as to apply its cutting surface to the coats of the bowel at that part."[1]

If the case be as I have stated it, the opinions and practice of which these quotations afford a specimen must tend to occasion great unnecessary suffering; and, therefore, believing that I have not in any respect exaggerated the benefits which are derived from the principles at present advocated, I think it right once more to state them.

1. In complete fistula, the internal opening does not lie farther from the anus than an inch and a quarter, and is frequently much nearer to it.

2. In external fistula not communicating with the gut, the mucous membrane is denuded and attenuated at the part where the opening would be if there were one.

3. In performing the operation, it is merely necessary to divide the parts lying between the external and internal apertures, or denuded part of the mucous coat corresponding to the latter.

4. In the after-treatment, it is not necessary to interpose any dressing between the edges of the wound beyond the first forty-eight hours.

Having thus endeavoured to explain the pathology and treatment of fistula in general, I may now consider more particularly the different stages of the complaint.

When the formation of matter in the vicinity of the anus is threatened by the occurrence of pain, hardness, or swelling of the part, it is usual to abstract blood locally by leeches or cupping. Some relief may thus be generally obtained,—but the improvement

the side of the gut, and then perforated it; this also was laid open. There was considerable hemorrhage at the time of the operation; but the patient fainted, and the bleeding stopped; and, when the wound was dressed, he went to bed. After he had been in bed about an hour, the hemorrhage returned, and the bleeding artery was so high up the sinus, as to be entirely out of the reach of the needle and ligature; the gut, therefore, and the wound, were filled up with compresses of lint, wet with spirit of turpentine; and, for some time, it was thought that this mode of compression had succeeded in stopping the hemorrhage; but, during our fancied security, his pulse became hardly perceptible, his lips pale, and the whole of the body was in a cold sweat. He was now supported by wine and other cordials; and, in a short time, the hemorrhage burst out again, with as much violence as ever, and continued for more than an hour. All the compresses were now removed, the rectum cleared as much as possible of coagulated blood, and the wound left without any dressings. The hemorrhage stopped, and did not return again; but very large quantities of coagulated blood were evacuated with the fæces for three days afterwards. He was, as may be supposed, extremely debilitated by this loss of blood, but finally recovered his strength, and his fistula was dressed, and cured in the usual way."—*On Diseases of the Rectum and Anus*, pp. 159—161. 3d edition.

[1] Elements of Surgery, vol. iii. pp. 70—82.

is neither complete nor permanent, and the progress of the complaint, though it perhaps becomes more slow, is not less troublesome,—being rendered sluggish and unmanageable. The application of heat and moisture, by means of the hip-bath or fomentations, has a very soothing effect on the patient's uneasy feelings, and accelerates the termination of his complaint, either by inducing resolution of the inflammatory action, or promoting suppuration. Evacuation of the bowels should be facilitated by the administration of gentle laxatives, such as castor oil, and injections of warm water into the rectum; and the patient must confine himself to the horizontal posture, as well as the antiphlogistic diet, with strictness in proportion to the acuteness of his symptoms.

So soon as fluctuation can be perceived, it is considered right to evacuate the matter, which otherwise might diffuse itself into the neighbouring loose cellular texture, and lay the foundation of troublesome sinuses. The knife is now almost exclusively employed for this purpose, and a free incision is made by it from the hip towards the anus, through the centre of the undermined integuments. Poultices are then applied for a few days until the inflammatory engorgement subsides, after which the cavity gradually contracts, and the case passes into the condition of a sinus or fistula. It might be thought better to divide the septum between the abscess and gut in the first instance, and some practitioners have advised this to be done. But it appears that recovery after the operation is not so speedy or so certain, when it is performed thus early, as when it is delayed until the textures affected are allowed to subside into their natural state.

In examining a case of fistula with the view of operating, the fore-finger of the left hand should always be introduced into the rectum, while the probe is guided with the other, since it is otherwise almost impossible to discover either the existence or the position of the internal opening. The probe should be slightly curved, and have its concavity turned towards the opposing finger, which is often able to detect the orifice, or rather the irregular induration surrounding it, and thus assist in directing the instrument. If there is no internal opening, the same exploration will discover the denuded part of the mucous membrane which occupies its place, and equally with it determines the limit of the incision. As the fistula is situated most frequently on the right side of the anus, and very rarely either behind or before it, the most convenient position in general is stooping forward, with the arms resting on a table or chair. But when the orifice happens to be on the left side, unless the surgeon is ambidexter, the patient should be placed on his back, with the limbs elevated.

In performing the operation, a knife will be found the most easily managed, which is narrower in the blade, particularly at the point, and less curved than the bistouries in common use. It should be gently insinuated up along the fistulous canal, while the operator's finger in the rectum assists in guiding its direction, and passed through the internal aperture, if there is one, or pushed

through the mucous membrane, if it still remains entire; the point, resting on the finger, is then brought out of the gut; after which, by a sawing motion of the blade, or a steady movement of it forwards, the septum is divided almost instantaneously with little pain, and hardly any bleeding. When much difficulty has been experienced in finding the internal opening, it is a prudent precaution, especially for a surgeon not much practised in the operation, to push the probe through the sinus, and bring its point out at the anus, before using the knife, since it is thus impossible to miss the orifice by transfixing the thin membrane which surrounds it. If any sinuses extend under the integuments of the hip or perinæum, they should now be laid open with the knife, and then small pieces of dry lint are placed between all the cut edges. This dressing will require to be renewed on the following day, when the patient's bowels have been moved, and after this a pledget of lint, moistened with a weak solution of sulphate of zinc, or water alone, and covered with a piece of oiled silk, to prevent it from drying, may be placed over the wound until the cure is completed. A T bandage, or couple of handkerchiefs put on in this form, will enable the patient to keep the dressing applied without confining himself to the horizontal posture, which, beyond the first day or two, is quite unnecessary. Great attention to cleanliness will be required, and frequent ablution with soap and water contributes not only to comfort but also to a speedy recovery.

What has now been said relative to the treatment of *fistula in ano*, applies to those cases of the disease that admit of remedy, which fortunately constitute a large proportion of the whole But before determining to operate, or holding out the probability of relief from doing so, it is necessary to ascertain that no obstacles exist likely to frustrate the surgeon's efforts, and defeat the patient's hopes. The most common of these opposing circumstances is a phthisical condition of the patient, which, as has been already observed, powerfully predisposes to the disease, and in the event of an operation being performed, is apt either to impede the healing of the wound, or lead to relapse through the formation of new abscesses. Any tendency to this condition, therefore, should render the prognosis in respect to an operation more or less unfavourable, though its performance cannot always with propriety be declined. Patients, after exhibiting symptoms of pulmonary disease, frequently recover so as to live for many years nearly or altogether free from complaint; and while the issue of their principal disorder is thus uncertain, it would be wrong to withhold the chance of recovery from the minor one, which often occasions more anxiety than the other. The refusal to operate also requires a very painful explanation; and the slight incision which has been shown to be all that is necessary for curing the disease, if it has not this effect, at least makes the patient more comfortable, by lessening the irritation of the parts concerned, and moderating the discharge. In these circumstances, unless the fatal disease is so far advanced as to render surgical interference improper, though the operation for

fistula may not with prudence be proposed or urged in consumptive cases, it may be performed if requested by the patient.

Fistulous openings near the anus, and leading into the rectum, sometimes communicate also with the urethra. The origin of this complicated form of the disease is an abscess, situated between the prostate gland and perinæum, which, from not being evacuated early by incision, discharges its contents into the urethra and rectum, before overcoming the resistance to an outward course, which is opposed by the fascia of the perinæum; and when at length openings do take place in the skin, they are usually situated at the verge of the anus and root of the scrotum. Flatus and thin feculent matter escape by the urethra, urine issues from the rectum, and a copious fetid discharge proceeds from the external orifices. The patient suffers great and unceasing distress, and, unless relieved by efficient treatment, ultimately sinks under the continued irritation and exhaustion.

These formidable consequences of allowing the abscess to open spontaneously, render it incumbent on the surgeon to be careful in recognising the disease at an early period, and giving free vent to the matter, by an ample incision through the integuments and fascia of the perinæum. The disease is generally induced by exposure to cold. It commences with pain in the region of the prostate gland, aggravated by micturition and going to stool, and is attended with more or less fever. When the matter begins to accumulate, difficulty is experienced in voiding the urine, sometimes to the extent of complete retention, and requiring the catheter to be introduced. The patient may continue in this state without any alteration, except the occasional occurrence of rigors, for eight or ten days, or even longer, until the fluid makes a way for its escape. The perinæum, when examined, is found to be fuller than natural. But, as the integuments retain their ordinary colour and consistence, this change may readily escape observation; and fluctuation, owing to the depth of the abscess, can hardly be perceived, unless the finger is introduced into the rectum, through the coats of which the fluid is easily felt. I have frequently been asked to draw off the water when obstructed in this way, without any suspicion having been excited as to the cause of difficulty, and have known the practitioner first take alarm from observing that the catheter contained pus. Examination by the rectum, together with the history of the case, will leave little room for doubt as to the existence of matter. But if there should still be any uncertainty, it will always be right to make an incision in the perinæum, since this can do no harm, and the withholding of it exposes the patient to the danger of all the distressing consequences that have been mentioned, as resulting from spontaneous evacuation of the abscess.

When the disease has advanced to its fistulous state, it is necessary to lay open all the sinuses; and even then the recovery is not always speedy or complete. The operation should be commenced by dividing the septum between the gut and the cavity left by the

abscess. For this purpose, the knife is introduced into the orifice which lies nearest the verge of the anus, guided upwards until it enters the gut, and then carried outwards through the septum, which in this case is generally more extensive than in an ordinary fistula, from the internal orifice being seated higher, even above the inner sphincter. The sinuses which extend between the anus and scrotum are next to be laid open, and then pieces of dry lint are inserted between the cut edges. The deep incisions which are sometimes required, expose the patient to the danger of hemorrhage; and if there should be any appearance of this, the bleeding vessels are, if possible, to be tied, or cold applied to the wound while the hips are elevated, which means seem far more effectual than pressure, owing to the looseness of the textures concerned. After the cure appears to be complete, a very small fistulous communication is apt to remain between the urethra and rectum, allowing a few drops of urine to pass occasionally. If this does not close within a moderate time, or proves annoying to the patient by exciting his alarm, a red-hot iron wire should be introduced into the orifice, exposed by a speculum, as often as may be necessary for inducing contraction and obliteration of the slender canal. In all cases of this kind, especially those which have been long established, it is proper to search the urethra and rectum for stricture; since this additional complication is not unfrequently met with, whether as a cause or consequence of the fistula it is not always easy to determine.

Fish bones, and other bodies of a similar form, are occasionally arrested in their passage through the alimentary canal by the *sphincter ani*—and may then penetrate the coats of the gut, so as to cause the formation of an abscess, which of course will not admit of being healed so long as the irritating substance remains. It is only by examination with the probe or finger that this complication can be discovered, the patient seldom being aware of having swallowed any thing improper, or at all suspecting the cause of his complaint. When the nature of the case has been ascertained, the fistula should be laid open in the ordinary way, and then, if necessary, more extensive incisions may be made to permit extraction of the foreign body without violence, or tearing of the surrounding parts.

Fistula in ano is sometimes found associated with stricture of the rectum, and in this case has been attributed to the resistance which is opposed to the passage of the contents of the rectum by the preternatural contraction of the gut. If so, the orifice ought to be situated higher up than the stricture, instead of which, it occupies the usual position, about an inch from the anus. The explanation thus afforded, therefore, cannot be received; and we must suppose that, if the stricture has any share in causing the fistula, it must act merely by exciting irritation in the neighbourhood. In regard to the performance of the operation, the presence of a stricture does not require any deviation from the usual course of proceeding; but the recovery of the patient will of course depend

upon the practicability of restoring the rectum to its natural capacity and texture.

The abscesses which result from the *morbus coxarius*, or hip disease, in its advanced stage, frequently open in the hip in its lower and back part; but those which proceed from caries of the sacrum, and those connected with exfoliations from the ischium or pubis, discharge their contents near the anus, so as to present the appearance of ordinary fistula at this part. It is obvious that, if the sinus depends upon caries, it will not be benefited by any extent or number of incisions; and that if it leads to an exfoliation, the detached portion of bone must be extracted, as an essential step to recovery. About ten years ago, I was asked to see a young man who had suffered several operations for what was supposed to be fistula, without obtaining relief, and had at length become exhausted beyond the hope of recovery. A careful examination led to the discovery of an exfoliation, lying inclosed in a capsule of cartilaginous firmness, formed by the origins of the flexor muscles of the knee, from the tuberosity of the ischium. After its extraction, the patient quickly recovered, so as to marry and have a family. I lately saw a young woman who had suffered from *fistula in ano* for five years, and wished to have the operation performed. On introducing the probe, I felt it grate past a hard surface, and extracted a thin scale of bone, which had probably been detached from the arch of the pubis, as she attributed her complaint to a strain sustained in hastily descending from the top of a coach.

CHAPTER II.

HEMORRHOIDS.

The expression Hemorrhoids, in the meaning usually applied to it, comprehends various tumours which grow at the verge of the anus. It thus denotes a disease of more frequent occurrence than perhaps any other to which the human body is subject, very few people, especially in the higher ranks of life, being entirely free from it in one form or another. The morbid swellings do not all possess the same constitution and characters, but differ in both respects so widely, as to require being divided into three distinct sorts. In the *first* place may be mentioned those which depend on enlargement of the veins at the extremity of the rectum. *Secondly*, those termed External Hemorrhoids, formed by enlargement of the thin skin and subjacent cellular texture, which, lining the orifice of the gut, and connecting the mucous membrane of the bowel with the external integument of the body, though naturally seated neither within nor without the sphincter, projects beyond it

when distended by inflammatory engorgement. *Thirdly*, those which consist of a vascular development of the mucous membrane, constituting tumours that possess a great tendency to bleed when protruded without the anus. They do not occupy this position except in consequence of the expulsive efforts employed in evacuating the bowels, and so soon as these cease to operate, or pressure is applied externally, return into their proper place within the sphincter, whence they are named Internal Hemorrhoids. Before particularly considering the structure, symptoms, and treatment of these tumours, it will be proper to enquire generally into the circumstances which determine their formation.

Causes of Hemorrhoids.—When the bowels are evacuated, more or less of the lining membrane of the anus is everted, and distended by the resistance which is then opposed to its venous circulation. Constipation, by rendering the expulsive efforts more continued and laborious, must increase this effect, and tend to produce permanent enlargement of the protruded part. But constipation usually depends on errors of diet or regimen, particularly redundant nourishment, and deficient exercise, causing derangement in the healthy action of the digestive organs, that not only leads to irregularity in the evacuations, but likewise, through the medium of constitutional disturbance, proves a fruitful source of local disease; and as the parts about the extremity of the rectum are in such circumstances, as has just been explained, exposed to more than usual irritation, it is not surprising that they should frequently become the seat of morbid action. The disease being once established, will promote its own increase by impeding evacuation of the bowels, and from the pain as well as hemorrhage attending it, deranging the healthy action not only of the digestive organs, but likewise of the whole system. Pregnancy, enlargement of the liver, and other abdominal tumours, will, by opposing a free return of blood from the pelvis, favour the production of hemorrhoids, especially those which depend upon a varicose state of the veins. In addition to the exciting causes which have been mentioned, it would appear that a predisposition to the disease frequently exists, since in some people it is induced much more readily than in others. Persons thus prone to the complaint occasionally suffer from it at the age of puberty; but it seldom proves troublesome until the frame is fully developed, and is generally most distressing from the age of 20 to 50.

Venous Hemorrhoids.—The lower part of the rectum is supplied with numerous veins lying under the mucous membrane, through which they may be readily distinguished. These vessels in the neighbourhood of the anus are liable to varicose enlargement, and then present the appearance of irregular tumours encroaching on the cavity of the gut. They extend for an inch or two above the anus, but hardly show themselves beyond it, unless the nates are held aside, when they may be seen projecting from the sides of the orifice. They possess a dark colour, smooth surface, circumscribed form, and tense consistence. The veins thus altered are liable to inflammation of the same sub-acute kind to which the varicose

vena saphena is subject. In this state they become larger, harder, and excessively painful, especially when in the slightest degree compressed, so that sitting and evacuating the bowels occasion great distress. The blood circulating through them frequently coagulates during such attacks; and if it subsequently undergoes absorption, a spontaneous cure may be accomplished. At other times suppuration ensues in the surrounding cellular substance, and may thus lay the foundation of *fistula in ano*. A discharge of blood also occasionally proceeds from ulceration of the enlarged veins, just as happens in the leg.

This form of the disease has attracted more attention than either of the others, and has even been supposed to be the sole cause of hemorrhoidal swellings. In a slight degree it is certainly very common, and to this extent frequently exists, along with enlargement of the neighbouring textures; but without such combination it rarely attains sufficient size to produce much inconvenience, or attract the patient's notice. The situation of the visible part of the tumours, neither within nor altogether without the sphincter, together with their form, consistence, and colour, render their recognition very easy. In regard to the treatment, the tendency of the venous tissue to resent irritation forbids any operation; and excision as well as puncture, which have been recommended, should both be carefully avoided, lest they excite inflammation of the enlarged vessels, and give it the unmanageable character which distinguishes it when of traumatic origin. Soothing measures are the most useful, such as rest in the horizontal posture, gentle laxatives, as castor oil, injections of tepid water into the rectum, and the hip-bath. When the symptoms are severe, leeches may be placed round the anus, opiate injections should be employed, and lotions, containing acetate of lead with opium, applied to the inflamed parts. By these means the paroxysm is subdued in the course of a few hours, or days at the farthest; and by care afterwards in guarding against the causes of excitement, future attacks may either be prevented or rendered less distressing.

External Hemorrhoids.—The thin skin which connects the internal mucous and external cutaneous covering at the anus, like the same texture in other situations as the lip and prepuce, is liable to swelling, from distension of the loose cellular substance which lies under it. Any irritation in the vicinity may occasion this; and the derangement once induced contributes to its own increase, by causing protrusion of the affected part beyond the sphincter, when, the circulation being impeded, the tendency to inflammatory engorgement is promoted. A tense red tumour, or series of tumours, may now be seen at the margin of the anus, easily distinguishable from varicose veins in the same situation, by their florid colour, pyriform shape, and more yielding consistence. In other respects the symptoms are nearly the same. The inflammation usually terminates in resolution, but sometimes leads to suppuration, and also, though very rarely, proceeds to mortification. When the engorgement attending the excited action subsides, the

distended skin may resume its natural condition completely, but, in general, does so only partially, and remaining relaxed, constitutes a permanent pendulous fold at the orifice of the gut, always ready to resent any irritation, and swell to its former or even a still larger size.

The artificial mode of life which results from the usages of civilised society tends so strongly to the production of hemorrhoidal disease, that few people remain altogether free from it; and this form is the one which it most frequently assumes, often existing independently of any other morbid affection, and very generally accompanying other diseases of the rectum. Various methods have been pursued in the treatment of external hemorrhoids; but it is needless to mention any other than excision, since this is undoubtedly the best mode of removing them. Scissors curved to one side will be found the most convenient instrument for the purpose, and may be employed either alone, or with the assistance of a hook to steady the tumours during their separation. The operation is very easy, and attended with little pain or bleeding. It is also quite effectual. The best time for its performance is when the hemorrhoids are in a quiescent state; and it should always be insisted upon when they are present in a case requiring any other operation, since, unless removed previously, or at the same time, they would be apt to suffer from the irritation, and, by adding the complication of inflamed piles, greatly increase or prolong the patient's sufferings. The blades of the scissors should be directed from the circumference towards the centre of the anus, in order to get at the root of the tumours without taking away any sound skin. A piece of dry lint is the only dressing required in the first instance, and often proves sufficient, as the raw surface readily contracts and heals. If necessary, a sulphate of zinc lotion may be applied.

While the hemorrhoids are suffering from inflammation, excision may still be practised, and it should be resorted to if the patient is willing to endure the pain that attends cutting in this state, in order to get speedily relieved from the complaint. If it be thought better to delay the radical cure until the parts get into a condition more favourable for its easy performance, the same soothing means that have been already mentioned as proper in the cure of inflamed venous hemorrhoids should be employed. Unless the tumours are very tense, it is also useful to make gentle pressure on them, to unload their vessels, and promote their return within the sphincter.

As excision always affords an easy, safe, and effectual remedy for external hemorrhoids, it seems unnecessary to say much of the other means which have been proposed, and more or less extensively adopted. The ligature is decidedly objectionable, as being infinitely more tedious, and also more painful than the knife or scissors, without any compensating advantage. The application of astringent ointments, such as the *Unguentum Gallorum*, is very inefficient, and calculated rather to amuse the patient than to afford him any real benefit; and the introduction of bougies can hardly produce more than a little temporary relief. The best palliatives

are attention to regimen, the use of gentle laxatives, such as sulphur with cream of tartar, and Ward's paste, which in all diseases of the rectum attended with relaxation has often a remarkably good effect. A portion of it, about the size of a nutmeg, may be taken twice or thrice a-day. Of local applications the ointment just mentioned, together with an admixture of opium, or subnitrate of bismuth, may be regarded as the best.

Internal Hemorrhoids.—The mucous membrane at the extremity of the rectum, immediately above the thin skin, which is the subject of the last mentioned swelling, is liable to a morbid development of its texture that gives rise to very serious symptoms. There are thus formed tumours seated altogether within the sphincter, unless when forced into view by sufficiently powerful expulsive efforts, and hence named Internal Hemorrhoids. They possess an irregularly round form, a florid colour, a granular uneven surface, and very vascular structure, so as to bleed freely from the slightest injury. They resemble a strawberry very much in appearance, and, seldom existing singly, in general constitute a more or less complete annular swelling, which, when protruded beyond the anus, seems to close the aperture of the gut completely, and is surrounded by an external ring proceeding from distension of the neighbouring loose texture, which is the seat of external hemorrhoids. The two kinds of growth are easily distinguished, not only from their difference of position, the one being seated within the other, but also by their difference of surface, the one being smooth and the other granular.

The substance of the internal hemorrhoidal tumour is so vascular and disposed to bleed, especially when forced beyond the sphincter, that it has been considered similar to the erectile tissue which composes aneurism by anastomosis and nævus. But these diseases are, with few if any exceptions, of congenital origin; while internal hemorrhoids rarely make their appearance before the age of maturity; and the vessels of the latter growth, instead of being dilated into the cellular-looking structure which composes the former, are small and arborescent. There hence does not appear to be any analogy between the two morbid structures farther than their disposition to bleed.

How this growth of the mucous membrane originates it is not very easy to explain. The circumstances which have been mentioned as accounting mechanically for distension of the veins and swelling of the lax textures at the verge of the anus, cannot operate here; and we must be satisfied with enquiring into the causes which operate less directly in producing the disease. Like other hemorrhoidal affections it occurs chiefly in the vigour of life. It is much more common in males than females, and in both sexes greatly more frequent in the higher than the lower ranks of society. Residence in warm climates, a luxurious diet, deficient exercise, and excitement of the generative organs, are the circumstances which seem to have the most powerful influence in determining its commencement, and encouraging its progress, especially when several

of them operate together. Literary pursuits and a professional life, which admits or requires sedentary habits, are observed to favour the production of this morbid excrescence. It would seem, in short, that the superfluous nourishment usually acquired by persons in easy circumstances, when not expended in bodily exertion, is apt to find vent through the channel of internal hemorrhoids, into which it may be directed by the opposition afforded by a sitting posture to the free return of the blood circulating in the pelvic viscera.

The symptoms which attend this kind of hemorrhoid may be divided into three sorts, namely, painful sensations, protrusion of the tumour, and hemorrhage. Some patients complain of these inconveniences equally; others complain of them singly. But in general they are all present together, while one of them predominates by its severity, and the attention which is consequently bestowed upon it. The painful sensations are referred either to the seat of the disease itself, or to the urinary organs, with which the rectum is intimately united in sympathy. The pain of the swellings is sometimes described as dull and oppressive, at others sharp and lancinating. The irritation of the urinary organs occasions uneasy feelings in the course of the urethra, frequent desire to make water, and difficulty in doing so. There is no regular proportion between the extent of the disease and the severity of its symptoms, nor is there any difference observable in the appearance of the tumours adequate to account for the variety that occurs in the nature as well as the degree of the annoyance which they occasion, and which no doubt must depend upon individual peculiarities of local or constitutional irritability. A gentleman, about 35 years of age, complained of pain at the extremity of the rectum, which was seldom entirely absent, and from which he occasionally suffered so much as to feel quite unhinged and incapacitated for any exertion either of body or mind. On examination I could find no morbid appearance except a very small internal hemorrhoid, not larger than the point of the little finger, the removal of which completely relieved him. The urinary symptoms are sometimes so prominent as to call attention from the true seat of the disease. A gentleman, about fifty, suffered for years from excessive pain in the region of the bladder, with frequent desire to make water. He consulted a great many physicians and surgeons of eminence, and had at length made up his mind that the disease, in accordance with the opinion of a distinguished pathologist, was tic-douloureux of the bladder, when a medical friend thought of examining his rectum, and discovered several large internal hemorrhoids, which I removed to the patient's great comfort.

The protrusion of the swellings is a nearly constant symptom of the disease, and is troublesome merely in proportion to their size. At first the tumours pass beyond the sphincter only during the forcible and continued efforts to evacuate the bowels which attend constipation; but by and by they descend more readily, and return with more difficulty, requiring to be pushed up by external pressure; and in cases of old standing, where the skin lining the anus,

from being frequently put upon the stretch, remains permanently relaxed, hanging in folds round the orifice, the tendency to protrusion is so great, that the hemorrhoids descend not only on all occasions of going to stool, but also whenever the patient makes the slightest exertion, or even when he simply assumes the erect posture. The protruded part is of course painful, especially when subjected to pressure, and, by soiling the patient's clothes with the mucous and bloody discharge that issues from its surface, is a constant source of vexation. A middle aged lady, whom I saw with Dr. Begbie, had been confined for two years to the horizontal posture by hemorrhoidal swellings, which descended from the gut whenever she attempted to walk or stand. After the disease was removed she could walk for miles without any inconvenience.—A gentleman, about 50, whom I saw with Dr. Davidson, had suffered for upwards of eighteen years from a protrusion of this kind, and, holding an office in the courts of law, which frequently required him to sit for many hours in public, endured more distress than it is easy to describe or imagine. He was completely relieved by removal of the enlargement.—A man, about forty, from Dundee, was lately in the hospital here under my care on account of a hemorrhoidal protrusion, which had troubled him for more than twenty years, and latterly disabled him entirely for his occupation, which was that of a weaver. He returned home quite well.—Many other cases could be mentioned in illustration of the protrusion of the tumours constituting the prominent feature of the disease. It is such cases, which generally go under the title of *prolapsus ani*, and, being supposed to depend upon weakness of the sphincter, are palliated very imperfectly by the application of bandages to support the gut. Such means of palliation are no less unpleasant than inefficient, and in some respects, indeed, may be considered as even more irksome than the disease itself. It is therefore of the utmost importance to take a correct view of the derangement, which leads to an easy, safe, and effectual remedy.

The bleeding which proceeds from internal hemorrhoids is the most alarming symptom attending the disease, and the one which occasions the most serious effects. It takes place when the tumours are protruded beyond the sphincter, and varies in amount from a few drops to several ounces. The blood sometimes seems to ooze from the surface, and at other times springs out in a jet, extending, if permitted, to the distance of several feet; whence it is often supposed that the patient has ruptured a blood-vessel. The quantity lost at each time of going to stool is very unequal, and varies with the condition of the patient, increasing when there is general irritation of the system or excitement of the pelvic viscera, and diminishing in circumstances of an opposite kind. For weeks or months the hemorrhage may cease altogether, and then return more vigorous than ever; but its general tendency is to increase with the duration of the complaint. At its commencement the discharge of blood may in some instances be regarded as salutary, as it occasionally seems useful in relieving other parts of the system

from oppression. But when it becomes habitual and copious, besides the unpleasant feelings connected with it, very serious derangements of the system are apt to be produced. The patient loses flesh, and acquires a remarkable paleness of complexion, which is afterwards exchanged for a peculiar dingy yellow hue, like that of imperfectly bleached wax. The lips no longer possess their vermilion colour, and resemble those of a dead body; the tongue too has a blanched appearance very characteristic of the state induced by excessive or continued depletion. These symptoms are attended with great listlessness, or want of energy both of body and mind, disturbed sleep, irritability of temper, quick pulse, and headache, which is generally increased by rising up more than by lying down. Palpitation and pain in the region of the heart, and difficulty of breathing, are also frequently induced by slight exertion or agitation of any kind.

It is obvious that the condition which has now been described must not only prove very distressing in itself, but tend to the production of other serious diseases; and, therefore, ought to be remedied with the least possible delay whenever ascertained to be present. A popular prejudice has existed against interference with bleeding piles, on the ground that harm may arise from suddenly checking an habitual discharge; but the worst consequences thus anticipated are hardly to be dreaded more than those directly sustained from the disease; and the result of experience is quite opposed to the apprehension of harm being so produced. In illustration of the safety with which the hemorrhage may be arrested, even when of the longest standing and greatest extent, I may mention the case of a lady, whom I attended with Dr. Donaldson of Ayr. At an early age she had begun to suffer from hemorrhoids, and thirty years ago had been advised by the late Mr. Benjamin Bell to have them removed. This was declined, and the disease went on increasing with all the usual symptoms, until at length the bleeding, which for seven or eight years had been very profuse, so affected the general health as to excite the serious alarm of her friends. She exhibited in an extreme degree the peculiar aspect and other symptoms of exhaustion caused by a continued drain of blood. But very soon after the removal of the hemorrhoidal tumours, which were large and numerous, so as to encircle the aperture of the gut, she regained her strength together with a healthy look; and though three years have now elapsed since the operation was performed, she has not suffered any unpleasant symptoms from the sudden suppression of her complaint.

The existence of bleeding from internal hemorrhoids frequently escapes the observation of the medical attendant, from the patient carelessly overlooking or wilfully concealing it. In females, the delicacy of the sex, which is an additional obstacle to discovering the disease, should excite corresponding vigilance on the part of the surgeon; and whenever there is any ground for suspecting its existence, be the patient male or female, an examination of the

bowel in its most protruded state should be insisted upon before giving any opinion of the case. It is also very necessary to beware that the symptoms, especially those connected with the circulation, do not obscure the nature of the disorder, and make it appear to depend on what are really its secondary effects. As an instance of this, I may take the case of a gentleman, about forty, an English commercial traveller, whom I saw last spring with Dr. Alexander. He had laboured long under what was supposed to be disease of the heart, and been treated for this complaint by one of the most eminent provincial physicians in England. His waxy look, bloodless lips, and defective energy, together with irregular action of the heart, certainly afforded considerable ground for this opinion; but Dr. Alexander discovered that there was an internal hemorrhoid, which bled profusely every time the patient went to stool, and I removed it, with the effect of quickly restoring him to health. There is reason to fear that in such cases as this the cause has not only been mistaken for the effect, but may even have been supposed to exert a salutary influence in moderating the violence of its action,—in other words, that the flow of blood from the rectum depended upon disease of the head or heart, and was useful in lessening its force. Such erroneous views may have led to the equally erroneous practice of abstracting blood artificially in these circumstances, the effect of which may be easily imagined.

The treatment of internal hemorrhoids is generally regarded with much uncertainty and apprehension, from the conflicting opinions of practical writers on the subject, and the disagreeable results of some methods which have been pursued. Excision is certainly the quickest and easiest mode of removing the tumours, but is very apt to occasion a serious or even fatal hemorrhage. The blood does not readily escape externally, but, accumulating in the rectum, excites the desire to go to stool, and is then voided in the form of a dark coloured feculent-looking fluid, which may impose upon the attendants, and conceal from them the true situation of the patient. Sir A. Cooper has related the case of a Scottish nobleman who perished in this way, and several other instances of the same kind. If other practitioners had been equally candid, we should doubtless have had more testimony as to the danger of this operation; and every surgeon who has practised it must have experienced more or less alarm. Before my own views were settled as to the best means of treating the disease, I on one occasion cut away an internal hemorrhoid, which was partially protruded, and found it necessary to employ manual pressure for several hours to restrain the bleeding that followed. In another case of the same kind, I succeeded in securing the vessels by ligature. In order to obviate this danger, it has been proposed to transfix the base of the protruded part with pins, to prevent the raw surface from being drawn within the sphincter until the bleeding ceases, or is arrested by ligature.[1] But it is to be feared that the hemorrhage, though prevented so long

[1] Salmon on Prolapsus of the Rectum.

as the part was kept tense by the pins, might occur after their removal, unless they were allowed to remain until the orifices were sealed up with lymph, which could not be done without the risk of exciting inflammation and constitutional disturbance.

Excision being thus objectionable, caustics of different kinds, and the actual cautery, have been employed for destroying the hemorrhoidal growth, and might possibly be so managed as to prove useful in doing so. But as these means are excluded from modern surgery for this purpose, and as there is another which perfectly attains all that can be desired in treating the disease, I may proceed at once to speak of it, namely, the Ligature.

By applying a sufficient number of ligatures to the roots of the tumours, they may be certainly removed without any danger of bleeding. But it has been alleged, that, instead of this danger, another not less formidable is encountered in that of inflammation, spreading from the strangled parts, and either terminating fatally, or causing extensive suppuration and sloughing in the neighbourhood of the anus. The seeming resemblance between the condition of an internal hemorrhoid, to which a ligature has been applied, and a strangulated hernia, makes it appear likely that this effect would follow the operation; but experience teaches, what a more careful analysis of the cases would lead us to expect, that the bad consequences thus anticipated do not really present themselves. In a strangulated hernia, the circulation of the protruded parts is not entirely obstructed, but merely impeded, so as to cause inflammation, with its usual local and constitutional symptoms, aggravated by the importance of the affected part; while a hemorrhoid subjected to the ligature is completely detached from any share in the vital action of the system, which, consequently, cannot be influenced by its condition. Accordingly, however similar the two cases may appear at first view, their results prove very different; and I feel warranted, after very extensive employment of the ligature, to state, that it may be used without the slightest risk of serious or alarming inconvenience.

In order to account for the bad consequences which Mr. Copeland and others have related as occasionally attending the use of the ligature, it will be sufficient to remark, that if the threads are not drawn tight,—if such large portions of the morbid texture are embraced by them as to prevent the degree of compression requisite for preventing altogether the circulation through the tumours,—or if the whole of the disease is not included, disagreeable effects may not improbably ensue. Sir A. Cooper has advised that the ligatures should not be drawn tight, with a view of lessening the pain caused by them. But, with all deference to his high and justly esteemed authority, I feel no hesitation in stating, that though the suffering of the patient may in this way be rendered less severe in the first instance, it will ultimately be much greater, as well as more prolonged, and attended with more danger of spreading inflammation, than if the strangulation had been completed at once. To obviate this objection, it has been proposed to cut away the tumours, im-

mediately after they are tied, close or near to the knot, which method, it is obvious, must be attended with another danger, since the ligature, when thus left unsupported, will be apt to slip off, and permit the vessels to bleed. If the threads are drawn tight they will not so readily quit their hold; but in this case no advantage can be derived from removing the strangulated parts, which then cease to maintain any living action, and very soon collapse into the form of flaccid bags.

I thought at one time that the best plan of proceeding with the ligature was to include at first only a part of the disease, with the view of avoiding any risk of exciting more irritation than the part or patient could safely bear; but I am now persuaded that by doing so much more pain and danger of undue excitement are occasioned than by the summary process of tying all the tumours at once. In illustration of this I may mention the case of an eminent provincial practitioner whom I attended with Dr. Abercrombie. He had long suffered from the bleeding of internal hemorrhoids, and was at length reduced to a state of extreme exhaustion. From being a strong muscular man, he had become a feeble emaciated invalid, unable for any exertion of body or mind, with the waxy look, frequent small pulse, and headach in assuming the erect posture, which characterise the state arising from continued depletion. As the tumours were large and numerous, I commenced the treatment by tying one of the smallest, with the view of ascertaining what degree of of freedom might be used with the remainder. The ligature separated at the end of two days, but the other excrescences swelled and protruded from the anus to the excessive distress of the patient, who described his sufferings as intolerable, and alarmed the neighbours by his cries. As his pulse suffered little alteration in frequency or hardness, and his belly continued free from pain, no great apprehensions were entertained as to the result. The inflammation accordingly did not extend beyond the limits of the diseased growth, the whole of which mortified and sloughed off, leaving the patient completely freed from his complaint, though at the expense of much more suffering than had been anticipated.

It is not difficult to explain why a partial operation should produce such effects. The morbid texture of the hemorrhoidal tumours, like all other formations not entering into the original constitution of the body, being hasty and violent in its disposition to excited action, readily inflames when injured, and suffers more acutely than the natural textures. The slightest excitement is apt to make it swelled and painful, and when it is partially subjected to a tight ligature, inflammation so intense as to destroy its vitality may be occasioned, while, if the whole be included the separation takes place, not indeed without some uneasiness, but certainly without any of a serious or alarming character. On the same principle any operation attended with local irritation in the neighbourhood of internal hemorrhoids, is apt to be followed by troublesome consequences from their excitement. A gentleman came

under my care for *fistula in ano* with this complication. I advised that both complaints should be remedied at the same time, to prevent the irritation caused by an operation for one of them, from injuriously affecting the other. The patient, however, persisted in requiring the fistula to be cut by itself in the first place, which was done, and followed by a very distressing paroxysm of the hemorrhoidal disease. He returned to the country to recruit his health, and came back some weeks afterwards to have the excrescence removed. Another patient came lately above a hundred miles to be operated upon for fistula, and made no mention of any other ailment. I performed the necessary incision, and a day or two afterwards was surprised to see a large internal hemorrhoid protruding from the wound. He then told me that he had long suffered from bleeding piles; and I expressed my regret that this communication had not been made sooner, as both diseases might have been remedied together, with less inconvenience than he was then subjected to. It happened fortunately that the inflammation proved so intense as to destroy the tumour, which sloughed off, so that the recovery was completed without any farther operation, but certainly, as in the last case, with much more pain and confinement than if the hemorrhoid had been tied when the fistula was cut. Still pursuing the same principle, when any pendulous folds of skin are observed to surround the anus in a case of internal hemorrhoids, I should advise them to be removed with the scissors at the same time the ligatures are applied, lest they inflame and prove troublesome in consequence of the neighbouring irritation.

When the operation is to be performed, the patient should take a dose of castor oil, so as to evacuate his bowels previously to it, as they had better not be moved for forty-eight hours afterwards. The hemorrhoids having been fully protruded by a sufficient degree of straining, the patient either stoops forward, resting with his arms on a chair or table, or, if a female, lies on one side, with the limbs drawn up, so as to expose the parts concerned. The surgeon then introduces the fore-finger of his left hand within the sort of ring which is formed by the morbid growths, and, keeping it there as a guide, transfixes their roots in succession with a needle and double thread, directing from without inwards through the centre of each, close to the base. The ligatures, which should be waxed silk, of proved strength, are next to be tied as tightly as possible, each, of course, including the half of a tumour. Their ends are then cut away as near to the knots as may be, without endangering their security; and the protruded parts are lastly pressed gently back within the sphincter.

The symptoms consequent upon the operation, vary with the extent of the disease, and the irritability of the patient. There is seldom much, or, indeed, almost any complaint of pain until the ligatures are tied; and the patient even then, in some cases, feels little inconvenience. The suffering which attends this step of the process, however, is in general considerable, and often very severe. It is most intense at first, and usually subsides gradually in the

course of a few hours, until the uneasy sensation is little or not at all perceptible. Want of sleep is frequently one of the effects produced, and is sometimes so distressing and prolonged, as to excite serious alarm. It is accompanied with nervous excitement, rendering the patient restless, more or less incoherent in his ideas, and wild in appearance. The pulse is seldom much affected, and when it does suffer disturbance, merely becomes quicker, without any of the hardness which denotes an inflammatory state of the system. The bowels are constipated, so as not only to cease evacuating their contents spontaneously, but to require laxatives of greater power than is sufficient in ordinary circumstances. Difficulty of making water, sometimes amounting to complete retention, and requiring the catheter to be introduced, very frequently occurs, but seldom continues beyond the first twenty-four hours. In two cases, I have found it last for nearly a fortnight. When the patient goes to stool a day or two after the operation, there is either no protrusion at all, or a much smaller one than formerly, and in general no bleeding. Little inconvenience is experienced after the unpleasant effects immediately consequent upon the operation have subsided, until the ligatures separate, which is usually about the end of a week; when a painful feeling is often complained of in the raw surface left by the sloughs, and a little blood is occasionally discharged along with the evacuations. Soon after this, the irritated parts regain their natural condition, and all the disagreeable symptoms which proceeded from the disease, as well as those caused by the operation, completely disappear.

Such being the consequences of tying internal hemorrhoids, the treatment after the operation may be easily determined. An opiate, containing thirty or forty drops of the solution of muriate of morphia, should be administered to the patient if he complains of pain, and be repeated from time to time if it continues severe, or a somewhat larger dose may be injected into the rectum with a teaspoonful or two of warm water. Fomentations may at the same time be applied to the anus. And if, notwithstanding the use of these means, much suffering is still experienced, the hip-bath of poppy-head decoction should be employed. The retention of urine, if slight, may be relieved by giving the *spiritus etheris nitrici*, or the camphor mixture; and if more obstinate, will require the catheter to be introduced occasionally as long as it lasts. The patient should restrict himself to the antiphlogistic regimen, and drink freely of simple diluents, such as barley-water or lintseed tea, to lessen the acrimony of the urine. He should also confine himself to the horizontal posture until the ligatures separate. In general, very little requires to be done in the way of treatment, the patient, after the first hour or two, usually suffering little uneasiness, and even then scarcely more pain than what attends the disease during its state of excitement.

CHAPTER III.

PROLAPSUS ANI.

By *prolapsus ani*, is understood a tumour formed by protrusion of the coats of the intestine through the anus. Such tumours consist either of the gut in its whole thickness, or of the mucous membrane alone, in a state of morbid development. Being thus differently constituted, they should not be confounded together, as they usually are, but be carefully distinguished, since they have no resemblance to each other, either in the nature of their production, or the treatment which they require. In making this distinction, it is fortunately unnecessary to employ any new names, since, if the title prolapsus be confined to denote those protrusions in which the whole thickness of the gut is concerned, the other forms of the disease may be all referred to the head of Hemorrhoids.

In this restricted sense, *prolapsus ani* consists of a tumour generally round or oval, but sometimes cylindrical, varying in size from that of a small egg to that of the largest orange, exhibiting the slimy surface of a mucous membrane, and affording a copious secretion, of very similar appearance to red currant jelly. It is obvious that the connections of the lower part of the rectum must prevent it from descending, so as to present these appearances, which can be accounted for only by supposing that the higher part of the gut becomes invaginated in the portion below it, so as to project beyond the anus. In short, the derangement will be the same as that which is named Intussusception, with this difference, that in the latter case the invagination occurs higher up the intestine, beyond the reach of sight and touch. It has been maintained by some, that the lower part of the rectum alone was concerned in the formation of prolapsus, the protrusion of this apparently fixed portion being accounted for by the relaxation of its coats. But this explanation does not agree with the anatomical structure, the phenomena observed during reduction of the protruded bowel within the sphincter, or the appearances which have presented themselves in cases that terminated fatally.

In regard to the causes of prolapsus, it is of importance to notice, in the first place, that the disease is almost entirely confined to children, and persons of advanced age who suffer from a relaxed state of the *sphincter ani*. In the former it is produced by long-continued or inordinate straining to evacuate the bowels; and in the latter, it results merely from want of the usual resistance to descent from the anus. The excessive expulsive efforts are induced by irritations of various kinds,—of which may be particularly mentioned, teething, intestinal worms, stone in the bladder, and morbid states of the mucous lining of the alimentary canal. Weakness of the sphincter is generally connected with deficiency of nervous energy in the pelvic viscera or lower extremities; but sometimes depends on a want of power confined to the muscle itself, which

either loses its contractile tone, or is impeded in its action by a relaxed state of the parts which it embraces.

The symptoms of prolapsus vary with the size of the part protruded, and the degree of vigour with which the intestine resents its unnatural position. They are therefore in general more urgent in young persons, and less so in old people. There is always more or less uneasiness in the protruded part, and obstruction to the evacuation of the bowels; and if inflammation commences, the sufferings of the patient become extreme, terminating even in his death, or mortification of the invaginated portion of intestine. Though the bad consequences are not always very rapid in their progress, the disease, if left to itself, can never be regarded as free from danger, and should, therefore, always be remedied as soon as possible.

The treatment of prolapsus resolves itself into the means required for replacing the intestine, and those employed for preventing a return of the complaint. In order to attain the first of these objects, the patient should be laid horizontally on his side or back, with the limbs bent upon the pelvis, and desired not to hold his breath, which, by confining the abdominal viscera, opposes the ascent of the gut. The surgeon then grasps the tumour in his hand, having previously lubricated its surface with oil, and, gently but steadily compressing its neck while at the same time he urges on the body of the swelling, gradually pushes the protruded parts within the sphincter. In most cases this reduction is easily accomplished. But when it has existed for several days or longer, the coats of the bowel become so much thickened and painful, that the manipulation requires to be conducted with great care and patience.

The prevention of relapse may be accomplished variously, according to the circumstances of the case. If irritation be the exciting cause, it must of course be removed; and for this purpose different means will be required, according to its seat and nature. If a stone in the bladder is the source of disturbance, it must be cut out; if ascarides in the rectum, they must be expelled by proper medicines; if it proceeds from dentition, the gum must be scarified, and the ordinary soothing means employed; and if it be connected with an unhealthy state of the mucous membrane, astringents, anodynes, and gentle stimulants of a proper secreting action, together with regulation of diet and regimen, will be necessary. While attempts are thus made to withdraw the source of irritation, the patient should be prevented, so far as possible, from voluntary straining, which is apt to continue through the bad habits which have been acquired. With this view, the bowels ought not to be evacuated in the sitting posture usually assumed by children in doing so, as it renders the pressure of the diaphragm most direct upon the contents of the pelvis; and the patient should sit upon a chair so high as to prevent his feet from reaching the ground, which will keep the trunk erect, and moderate the force of the expulsive efforts. Care also should be taken to prevent him from sitting too long or too frequently at stool.

In cases of the other kind, in which the protrusion depends not upon inordinate pressure outwards, but upon deficiency in the usual resistance of the sphincter, while it is equally proper to reduce the prolapsed bowel without delay, the means of prevention for the future must be of a different kind. There being here no local irritation in existence, of course nothing can be done with the view of removing it; and the treatment is consequently limited to preventing the patient from voluntary straining, and to increasing the resistance of the sphincter. Constipation of the bowels, which necessarily leads to long-continued and laborious efforts at expulsion, should be carefully prevented by regulation of the diet and regimen; by the use of appropriate laxatives; and by the injection of tepid water into the rectum, which not only is a powerful assistant of medicines given by the mouth, but often proves sufficient to supersede their employment altogether. The enema syringe of Read, more convenient, perhaps, in its original form than any of the subsequent modifications which it has undergone, renders the administration of this means so easy and simple, that no difficulty need be experience in its habitual use. Every patient who suffers from constipation of the bowels, and more especially all those who have any tendency to prolapsus, should be provided with the apparatus.

When the weakness of the sphincter depends upon a paralytic state of the muscle little can be done for its remedy, and a bandage must be worn to support the rectum. But if the contractile power remains at all, though diminished by distension of the orifice, and impeded in its action by relaxation of the parts about the anus, the patient may frequently be relieved by a very simple operation. It consists in removing a portion of the pendulous skin which surrounds the orifice of the gut, and produces its beneficial effects, by relieving the sphincter from the obstruction to its efficient closure, which is caused by the presence of relaxed integuments, and by inducing consolidation of all the textures concerned, through the changes consequent upon the inflammatory action it necessarily excites. The source of irritation which, as has been already explained, is apt to proceed from the skin thus altered, is also in this way removed. Mr. Hey of Leeds removed the whole circle of pendulous skin. But M. Dupuytren found that the object in view could be equally well attained by taking away merely a few of the folds into which it is thrown when allowed to collapse round the anus. The scissors curved to one side prove most convenient for effecting this excision, and should be directed from the circumference towards the centre of the aperture. The folds of skin should be held tense by a hook or forceps, and be removed from the distance about an inch and a half quite up to the mucous membrane, a small part of which should be included in the incision. It is not necessary to remove more than four or five of the folds. Mr. Howship has recommended the ligature, instead of the knife or scissors, for this purpose, on the ground that it excites a more salutary degree of irritation. But the pain and delay attending its use would more

than counterbalance this alleged advantage, which may be compensated for by the freedom of excision.

In adults who are said to suffer from *prolapsus ani*, there is seldom any thing more protruded than the internal lining membrane of the bowel, more or less thickened or altered in its texture. The complaint, therefore, would be more properly designated internal hemorrhoids; and this correction of terms would prevent much confusion in practice, since, in such cases, instead of removing the morbid swellings, the treatment is in general erroneously directed to strengthening the sphincter, or supplying substitutes for it in the form of bandages. It is true that the symptoms may be alleviated by obviating constipation, using astringent applications and medicines, cutting away the folds of relaxed skin, or even by employing a bandage. But such treatment is merely palliative, and the relief is neither complete nor permanent; while, if the hemorrhoidal growths are recognised as the cause of the protrusion, it may be at once completely and safely remedied in the way that has been described; and the treatment of prolapsus, strictly speaking, will be confined to those comparatively rare cases in which the gut descends independently of any alteration in its texture.

CHAPTER IV.

POLYPUS OF THE RECTUM.

The rectum is sometimes, though very rarely, the seat of morbid growths from the mucous membrane, which resemble the tumours named polypi in other parts of the body. The extreme rarity of this disease may be estimated from the statement of Sir A. Cooper, that in the whole course of his experience he has met with only ten cases of it. He says that it generally occurs in children, and very rarely in adults, and that the most advanced age at which he has met with it was twenty-two. The few cases that have fallen under my own observation were in persons who had attained or passed the middle period of life. Except in cases where there is a general vegetation of morbid excrescences from the surface of the gut, and which are not, properly speaking, examples of the affection in question, polypus of the rectum always, so far as I know, occurs singly. The tumour is of a round or pear-shape, varying in size from that of a pea to the bulk of a hen's egg, and either smooth or lobulated on the surface. It has a narrow neck or footstalk, which is usually attached within an inch or two of the anus. In its consistence there is considerable variety, the texture being sometimes firm and unyielding, at other times soft, and hardly distinguishable by touch or ocular inspection from the lining coat of the bowel.

The causes which give rise to such productions are quite un-

known, since the difficulty of discovering the tumour while still small and recently formed, together with the want of frequent opportunity for observing its development and progress, throw much obscurity upon the circumstances attending its origin; but if successfully investigated, they would probably be found to consist in circumstances of an irritating nature.

The symptoms are similar to those of internal hemorrhoids, being a sensation of weight and uneasiness in the rectum, pain, and frequently a discharge of blood in going to stool, and irritation of the bladder and uterus. The footstalk is sometimes so long as to allow complete protrusion of the tumour beyond the anus, in which case its existence cannot be overlooked. But when it is retained within the rectum, a very careful examination with the finger is necessary for detecting its presence.

The treatment of course requires removal of the polypus, and this may be effected either by excision or by the ligature. There does not appear to be the same danger of bleeding from the former of those methods, as when it is employed for the extirpation of hemorrhoidal tumours, but there must always be more or less risk of unpleasant consequences from this source, and the ligature should therefore be preferred. In a case which I saw with Dr. Hilson, of Jedburgh, the tumour, which was about the size of a cherry, and appeared to have existed for upwards of twenty years, was attached to the posterior surface of the gut by a slender footstalk, long enough to permit its being readily protruded from the anus. A single ligature might have proved effectual, but, to make the strangulation as complete as possible, I passed a needle through the root of the growth, and tied each of its halves with a separate thread. The patient, who was a lady upwards of seventy years of age, recovered without any inconvenience. In another case, for which I am indebted to Mr. Craig, of Ratho, it was necessary to pursue a different method.

"In January 1835, Mrs. H. aged 44, was delivered of her ninth child. The labour was in every respect natural and easy, and she made a good recovery.

"On the 2d of April 1836, I was sent for to visit her, and upon my arrival found that she had had a very profuse discharge of blood from the rectum. She was pale and exhausted, with a small feeble pulse. As the bleeding had ceased, and I was unwilling to disturb her, I merely prescribed the horizontal posture and doses of acetate of lead, with Dover's powder every four or five hours. The quantity of blood discharged could not be accurately ascertained. I saw two common water-pots nearly full, the one with scybalous fæces and blood, the other apparently with blood. But she told me that more had been previously passed to the extent of inducing syncope. There was no return of the bleeding, and she made a good recovery.

"On investigating the nature of this case, I was informed by the patient, that for fifteen years she had been more or less annoyed by uncomfortable sensations in the pelvis, with pain in her back, loins,

and thighs: That some years ago, while pregnant, and within six weeks of delivery, she had had a similar bleeding nearly as profuse, after which she made a very tedious recovery: That during the births of her younger children, she had been sensible of an uneasiness in the posterior parts which was not formerly remarked: That when she strained at stool something frequently came down, which required to be returned; and that she had consulted a variety of practitioners for the complaint, without obtaining any relief.

"I could hardly think, as seemed to have been previously supposed, that the uterus was the seat of the disease, because her labour had been natural; because the menstrual evacuations were regular; and because when examined it was felt of the ordinary size as well as consistence. Suspecting that piles might be the cause of her complaint, I carefully examined the rectum, and in the hollow of the sacrum detected a large pendulous tumour attached to the gut by a narrow neck. It was lobulated on the surface, and in consistence resembled the placenta or lung. It could not be protruded. But this seemed owing rather to its size than the resistance of its root. Pulling it gently occasioned pain shooting through the pelvis. It was sensible to pressure near its origin, but not in its mass generally. Having no doubt that this polypus was the cause of all her suffering, I proposed its removal; and on the 18th of November, Mr. Syme effected this by applying a ligature round its neck. In the course of a few days afterwards the tumour sloughed away in different pieces, which did not permit its structure to be satisfactorily ascertained. After this her general health improved, and she was relieved from all the disagreeable sensations which had so long distressed her, and at length produced a serious depression of spirits."

Great credit is due to Mr. Craig for discovering the polypus in this case, since the consistence of the tumour, as recognised by touch, was so similar to that of the intestinal coats, that I could not satisfy myself of its presence, except by feeling the neck and tracing it into the body of the swelling. The ligature was passed by introducing it on the point of the finger, carrying it round the footstalk, and then withdrawing it by means of a hook.

CHAPTER V.

STRICTURE OF THE RECTUM.

The rectum, like the œsophagus, which it resembles in many other points of structure, size, and morbid derangement, is liable to stricture of two different kinds. In one of these there is merely contraction of the coats, with thickening and induration of their texture. But in the other there exists a morbid growth, attended with the symptoms, and prone to the changes, which characterise malignant degenerations of structure. Want of attention to this

very obvious and necessary distinction has often led to great misapprehension in regard to the nature of the disease, and serious errors of practice in its treatment. By some it has been looked upon as always admitting of remedy at an early stage, and by others it has been considered always incurable; while the good effect of introducing bougies in cases of the simple or non-malignant kind has encouraged those who supposed the stricture to be constantly of a carcinomatous nature, to expect benefit from the employment of pressure in the treatment of cancer occurring in other parts of the body.

Simple Stricture of the Rectum.—The simple stricture is seated very near the lower extremity of the rectum, a little within the sphincter, between two and three inches from the anus. It is here that the gut changes the direction of its course, and after following the curvature of the sacrum, makes a sudden turn outwards to its termination. There is thus formed a sort of angular projection by the posterior surface of the bowel, which may be supposed likely to increase when subjected to continued irritation of any kind, and at length to constitute an inconvenient degree of contraction. It has been maintained that this is not the sole seat of stricture in the rectum, and that the disease frequently occurs farther up the canal, especially at the distance of five or six inches from the anus. Indeed, some have gone so far as to profess their ability not only to recognise, but to treat it successfully when seated beyond the rectum altogether, in the sigmoid flexure of the colon. That contractions of the great intestine may occur in any part of its course, I do not mean to question. But that the thickening and induration of its coats are in such cases usually confined to the narrow limits which constitute a stricture in the ordinary acceptation of this term, or that the strictured part can be accurately ascertained, and efficiently dilated by the use of instruments, I have no hesitation in expressing my unqualified disbelief.

It is very natural for persons suffering from constipation to suppose that obstruction of the bowel is the cause of their complaint; and they are consequently ready to believe in the existence of stricture, when it is intimated to them by their medical attendant, especially if, at the same time, hopes of relief are held out from the employment of mechanical treatment by dilatation. There is too much reason to fear that unprincipled practitioners have taken advantage of this facility in the disposition of their patients to promote their own unworthy views. But I should be sorry to allege, that a want of good faith was requisite either for the discovery or the treatment of strictures high up the rectum. The practitioner is hardly less exposed to deception than the patient; and if he examine the rectum, under an impression that there is a stricture existing in it, he will be very apt to believe that he has found one. In the feeble and unhealthy persons who are usually suspected to labour under the disease, the coats of the rectum are so thin and relaxed as readily to catch the point of the bougie employed for exploring the cavity, and thus impede its progress, which is also

apt to be arrested by the promontory of the sacrum. As an instance of this, I may mention the case of an elderly lady whom I saw with Dr. Begbie. She had been supposed to suffer from stricture of the rectum, between five and six inches up the gut, and had been subjected to treatment for it during several years before coming under Dr. Begbie's care, by two gentlemen of the highest respectability in this city. Finding that the coats of the rectum, though greatly dilated, were quite smooth, and apparently sound in their texture, so far as my finger could reach, and conceiving that the symptoms of the case denoted a want of tone or proper action, rather than mechanical obstruction of the bowels, I expressed a decided opinion that there was no stricture in existence. Not many months afterwards the patient died; and when the body was opened not the slightest trace of contraction could be discovered in the rectum, or any other part of the intestinal canal. One of the gentlemen who had been formerly in attendance was present at this examination; and wishing to know what had occasioned the deception,—which he said had led to more than *three hundred hours* being spent by himself and colleague in endeavours to dilate the stricture with bougies,—he introduced one as he had been wont to do, and found that, upon arriving at the depth it used to reach, its point rested on the promontory of the sacrum. Other cases might be mentioned to illustrate the uncertainty of information as to the capacity of the higher part of the rectum, obtained by exploring the gut, and to show how far the best intentioned practitioners may be misled by the sources of fallacy I have endeavoured to explain.

If the symptoms of stricture of the rectum could be traced at an early stage of the disease, difficulty in evacuating the contents of the bowels would probably be their most remarkable feature. But the complaint almost always steals on insensibly, so as not to attract attention until fully formed; and then the inconveniences experienced are so different from what might be expected, that they tend rather to obscure than to indicate the nature of the complaint, which is therefore seldom suspected by the patient. There is at present in the hospital here, a woman who was admitted on account of a *fistula in ano*, in whom, on introducing my finger into the rectum, to guide the knife in dividing the septum, I found a stricture in the ordinary position, so tight as to exclude any thing larger than a moderate-sized urethra bougie; yet she had been quite unconscious of its presence, though the symptoms proceeding from it were extremely severe. The reason of this is, that the effects of a confirmed stricture are in general the frequent, often almost incessant, discharge of thin feculent matters, owing to the copious secretion of mucus which results from the irritation of the disease; and that the thin slimy stools, occasionally tinged with blood, attracting more notice than the small indurated masses of fæces passed along with them, make the case assume the appearance of diarrhœa. The mistake thus committed, not only prevents the proper means of remedy from being employed, but leads to the administration of astringents and anodynes, which must prove

hurtful, by checking the process instituted by the system for its own relief. This consists in the copious secretion of fluids into the cavity of the great intestine, which lessens the solidity of the feculent matters, and facilitates their passage through the narrow channel that remains for their escape. Being forced down upon the stricture by the violent efforts at expulsion, which are made to unload the distended bowels, a small quantity is urged through the stricture, and issues from the anus in a sudden jet, as if propelled by a squirt. The grand character of the disease in its advanced stage, then, is the frequent squirting out of thin feculent matters, containing no solid masses, or only very small ones, and mixed with blood or mucus, accompanied by a sensation of cutting or burning in the rectum. In addition to this, the abdomen is distended, partly by retention of its feculent contents, partly by tympanitic swelling, caused by derangement of the bowels. Pain also is felt in the sacrum, extending down the limbs; and abscesses frequently form in the vicinity, so as to lay the foundation of *fistula in ano*. In this case, the sinus does not, as has been alleged, open into the gut above the contracted part, but holds its usual position near the anus, and should be regarded rather as an accidental consequence of the neighbouring irritation, than as a direct effect of the stricture.

The disease is met with more frequently in females than males, and generally occurs about the middle period of life. It is extremely distressing; and, if not remedied, may at length prove fatal, by gradually exhausting the patient's strength, or exciting inflammation of the bowels. Some years ago, I attended a gentleman for *fistula in ano*, together with stricture of the rectum. Not long afterwards, he told me that his wife complained of symptoms similar to those he had suffered from the latter ailment. I proposed an examination of the rectum, which was declined, and I heard no more of the patient, until raised one night with an urgent request to visit her immediately. She was labouring under the symptoms of peritonitis in its advanced stage, and died before the end of many hours. The rectum was contracted almost to obliteration at the usual part. Instead of terminating thus abruptly and violently, the disease more frequently, when it proves fatal, gradually exhausts the strength of the patient, by the continued uneasiness, and derangement of the digestive functions, which attend it. Extreme emaciation and hectic irritation are thus induced; and unless some other disorder occurs to arrest his sufferings, he at length sinks under the complaint. The progress of such cases is by no means rapid; and the disease, after attaining a certain extent, often seems to remain stationary; so that there is usually ample opportunity for its discovery and treatment.

From the slow and insidious formation of stricture in the rectum, it is not easy to ascertain the circumstances which give rise to it. The analogy of what happens in other mucous canals, would lead to the supposition, that continued irritation of the gut is probably the immediate exciting cause. But the precise way in which this

state is occasioned, or why, when its other effects are so common, it should so rarely produce the effect in question, are points that have not yet been satisfactorily made out.

In the treatment of the disease, some temporary relief may be derived from injecting tepid water or oil into the rectum, to soothe the irritation of its coats, and facilitate the discharge of its contents. But as the patient, by such means as these, cannot be freed from his complaint, it is necessary to enquire how the gut may be restored to its natural capacity. Of the means employed to remedy strictures of mucous canals in general, namely, the caustic, the knife, and the bougie, the two last mentioned have alone been resorted to in treating stricture of the rectum. Division of the contracted part with a cutting instrument, notwithstanding the obvious risk of hemorrhage and inflammation incurred by doing so, has been occasionally practised; and with such speedy as well as complete relief, that some practical writers regard this method as the one which ought to be preferred. But as experience has ascertained that, in certain conditions of a constitutional and local kind, wounds of the rectum, even though of very small extent, are followed by serious or fatal consequences; and as the bougie, though not so speedy in its operation as the knife, is equally effectual, and not exposed to the same objection, prudence seems to require that the practice of incision should be either entirely abandoned, or only used in particular cases with extreme caution. The best instrument for the purpose, is the blunt-pointed curved bistoury; and the stricture should be either divided backwards, in the direction of the sacrum, or notched at different parts of its circumference by cuts of smaller extent.

The use of bougies in removing strictures, is a remarkable example of good practice, originating from false principles. It was at first adopted with the view of destroying the obstruction through the effect of medicinal substances, which were in this way applied to the contracted part of the canal. And when experience had proved that bougies of the simplest composition, as those constructed of metallic substances, were not less effectual than those of the medicated kind, the process of improvement was next ascribed to the mere dilatation acting mechanically as on a tube of dead matter. Hence it was thought impossible to introduce the instruments too frequently, or for too great a length of time. At least once a day was thought essential, and they were permitted to remain for hours at a time. But the contracted canal is not composed of dead substance, and the stricture depends upon a peculiar morbid action of the living texture. The beneficial effect of the bougie, therefore, must consist in the excitement of another action opposed to the one formerly in operation, and capable of restoring the gut to its natural state.

It is the effusion of organisable matter into the cellular texture of the part that causes the stricture, and it is the absorption of this deposit which removes the disease. The bougie, by effecting pressure, excites the action of absorption. And if the pressure be

too great, too long continued, or too frequently repeated, there will be a great risk of causing more than sufficient irritation for the purpose; and of inducing again the very condition it is desired to counteract, the consequences of which must be a confirmation and increase of the disease. The perfection of treatment by means of the bougie, may thus be considered to consist in using it merely to the extent requisite for producing its beneficial effects; and this is now fully ascertained to be much less than might at first view have appeared possible. Instead of requiring to be introduced daily, and to remain in the passage for hours, it appears that the bougie causes a sufficient degree of excitement if used every third or fourth day, and withdrawn immediately after being passed through the stricture. Under this system, the improvement not only advances at least as quickly as when the operation is performed more frequently, but is likewise much more sure in its progress, and much less apt to be interrupted by undue irritation of the part concerned. These principles now regulate the treatment of stricture in all the mucous canals which are subject to it—namely, the urethra, œsophagus, and rectum.

Rectum bougies are constructed of various materials; and from the facility of guiding them through the stricture, owing to its position in the vicinity of the anus, the composition of the instrument is of less consequence than when the disease is seated in the urethra or œsophagus. Metals, wood, glass, and cloth, made up with plaster or elastic gum, may be employed. But, on the whole, those formed of iron and elastic gum are the most convenient. The former are cheap and imperishable; the latter are more expensive and liable to decay, but perhaps more easily introduced and less hurtful to the feelings of the patient.

When the operation is to be performed, the patient should be placed upon his side, and then the surgeon, having in the first place satisfied himself as to the precise position of the stricture, by feeling it with his finger, passes a bougie, lubricated with oil or lard, up to the obstruction, and presses against it steadily but gently. If the resistance cannot be overcome without using force or causing pain, he withdraws the bougie, and tries a smaller one in the same way, thus proceeding until he gets one to pass through the contraction, immediately after which he withdraws it, and concludes the process for that time. If necessary, some soothing means, such as an opiate injection, or the hip-bath, may be employed to allay any undue irritation that has been excited, even by this cautious proceeding. At the end of three or four days, or a longer interval, if the patient continues to suffer from the former operation, the bougie which was introduced upon that occasion is again passed, and followed up by another of larger size; and thus the treatment is carried on until the disease ceases to occasion any inconvenience, and a full-sized bougie can be introduced with ease.

Malignant Stricture of the Rectum.—There has been some difference of opinion as to the comparative frequency of simple and malignant stricture of the rectum. From my own observation of

the cases that come under treatment, I should say that the latter is more often met with than the former. It generally occurs in the same part of the gut as the simple stricture, but is not so limited or regular in its extent. The diseased growth is sometimes confined to one side of the gut, at others it affects the whole circumference; and it is only in the latter case that there is stricture, properly speaking, though it is usual to designate by this title all morbid growths occurring in the coats of the rectum. The swelling is usually of a very irregular form, and seldom extends less than several inches along the gut. Occasionally it descends quite to the anus, or even shows itself externally, but more frequently it leaves the coats of the intestine free for an inch or two within the sphincter. The morbid growth generally possesses a moderate degree of firmness, and exhibits characters intermediate between those of carcinoma and medullary sarcoma. It encroaches on the cavity of the rectum, so as to impede more or less the evacuation of the bowels, and being attended with the symptoms which are wont to proceed from such degenerations, occasions great and almost unceasing distress. The patient complains of a shooting or fixed dull pain in the back, at the upper part of the sacrum, and extending down the limbs, together with a sense of weight and uneasiness in the part affected, especially after motion of the bowels, or the operation of any circumstances causing irritation of the disease. He passes blood and purulent matter along with his stools, which are thin and frequent; and though in the earlier stage of the disease, difficulty may be experienced in passing them through the thickened coats of the gut, there is for the most part ultimately rather an inability of retention from the action of the sphincter being impeded by the progress of the disease. His countenance displays the greenish-yellow complexion characteristic of malignant disposition in the system, and he loses flesh as well as strength. On examination, the gut is found not only contracted, but thickened and irregular on the surface. The coats at the affected part are hard and unyielding, and the morbid growth is felt projecting into the cavity, sometimes in the form of rounded tubercles, at others rough with ulcerated depressions. As these changes, judging from touch alone, do not differ, except in degree, from those which attend the simple stricture, it would often be difficult to determine, merely by local examination, the nature of the complaint. But the symptoms which accompany it are so well marked, that the disease can hardly be either overlooked or mistaken. In its progress, the patient becomes generally exhausted, and falls into a hectic state, which is soon followed by dissolution.

In common with other malignant affections, carcinomatous stricture of the rectum does not admit of being remedied by any kind of treatment directed with the view of restoring the diseased part to its natural state, and its situation forbids any prospect of benefit from removal by the knife or any other means.

In these circumstances, palliation is all that can be reasonably attempted; and for this purpose, opiate injections, with the hip-

bath, are very useful. The patient should be enjoined to abstain from every kind of stimulating food and drink, and also to avoid any exertion of body likely to aggravate the complaint, resting as much as possible in the horizontal posture. The introduction of bougies, and all other operations, not only can do no good, but must ever produce an injurious effect, by increasing the irritation of the disease, and accelerating its progress. It appears that a considerable portion of the rectum, even to the extent of a couple of inches, may be cut out without immediately fatal or any very serious bad consequences in the first instance. But the patient can experience no benefit from this being done, and, in addition to the pain of the operation, must have an impulse given to the morbid action. And if there are any cases in which this excision of the rectum has been followed by a permanent cure, the disease could not have been of a malignant nature. It may seem unlikely that so severe a proceeding should ever be resorted to except in cases the most hopelessly incurable by other means. But, so far from this, however startling and incredible it may appear, the fact is, that removal of the extremity of the rectum has of late years been taught and practised in this city, as the best mode of treating those hemorrhoidal affections which are generally comprehended under the title of *prolapsus ani*. That a complaint which, as has been shown above, may be certainly remedied with little pain, no danger, and without any injury to the natural structure, should give occasion to an operation so dreadful in its performance and effects, as cutting out the end of the bowel, together with its sphincter, is to be deeply regretted, as well for the credit of surgery as the good of humanity. It is needless to say that, after this extirpation has been performed, the healing of the wound is attended with an extreme contraction, I have heard even obliteration, of the gut; and the patient must consequently, like the victim of the ancient operation for fistula, suffer from the united miseries of constipation and incontinence.

It is possible that cancer may occur at the verge of the anus, as it does in the somewhat similar texture of the lip, and then excision may be practised without any impropriety. But cases of this kind are extremely rare, and should be carefully distinguished from those in which the coats of the bowel are implicated, where the knife can never be prudently or beneficially applied.

CHAPTER VI.

SPASMODIC STRICTURE OF THE RECTUM.

Cases are occasionally met with in which the patient expresses great suffering from uneasy feelings referred to the neighbourhood of the anus, though no alteration of structure in the parts concerned can be detected by the most careful examination. It is

stated that the bowels are evacuated with difficulty and pain,—that the pain frequently does not come on until after going to stool, and then continues extremely severe for an hour or longer;—that sitting is very uncomfortable, unless the body rests on one hip, so as to protect the anus from pressure,—and that there is an unpleasant sensation of fulness in the perinæum, with heat in the urethra, frequent desire to make water, or other symptoms of irritable bladder. These complaints are not always equally severe, and often become greatly aggravated, from time to time, with more or less complete remissions, which are not unfrequently preceded by discharges of blood or matter from the rectum. The anus, instead of presenting its ordinary conical appearance, looks flat when examined, and hardly presents any trace of the orifice, owing to the inordinate contraction of the external sphincter muscle. If the finger be introduced, which is not accomplished without great pain and difficulty, every attempt to examine the gut causing excessive distress, not only at the time, but for hours afterwards, it feels much more strongly compressed than usual. And when the nates are held aside, so as to bring the lining membrane of the anus into view, one or more ulcerated fissures are occasionally observed between its folds.

This affection occurs in every rank of life, but is almost entirely confined to the male sex. From not being attended with any obvious alteration of structure, it is often considered imaginary, and treated merely as a nervous complaint. It has only of late years attracted the attention of the profession, and is yet far from being familiarly known to practitioners in general. Boyer has given an excellent description of the disease under the title of Fissure of the Anus,[1] believing that the excessive contraction of the sphincter depended upon the irritation of the ulcerated chops, which he thus designated. That these two morbid affections frequently exist together there can be no doubt. But that the spasmodic stricture is of secondary origin, and dependent upon the other, is not reconcilable with the facts presented in practice. In a considerable proportion of cases, I have found the sphincter firmly contracted, without any perceptible fissure or abrasion of the surface. And I have also, though more rarely, met with fissures producing great uneasiness to the patient, but not accompanied with spasmodic stricture of the anus.

It is very difficult to explain the cause or origin of this complaint. Its nature leads to the suspicion of some chronic excitement or irritation of the parts concerned, or those in their neighbourhood. Anxiety and distress of mind have evidently a powerful influence in confirming and aggravating its symptoms, and may not improbably also occasion its commencement. General irritability of the system may also constitute a predisposition to

[1] De la Fissure ou Gerçure de l'Anus, accompagnée du resserrement Spasmodique du Sphincter; Traité des Maladies Chirurgicales, Tome x. p. 125.

its production. And every thing that tends to irritate the rectum is of course apt to increase the patient's sufferings. Thus, introducing the finger or foreign bodies of any kind within the anus—forcibly expelling indurated matters from the bowels,—using stimulating articles of food or drink,—and remaining long in a sitting posture, are observed to be hurtful.

In the treatment of this spasmodic stricture, it has been found that the most effectual, if indeed not the only, means of affording relief, consists in making an incision through the constricted parts. Boyer recommended this operation as essential for the cure of fissures at the verge of the anus, which he considered the cause of the contraction. And though his theory in this respect seems questionable, the advantage of the practice cannot be disputed. But the good effects of an incision are no less remarkable when there is merely contraction without fissure; and therefore, in a practical point of view, it is of little consequence how the two affections are supposed to be connected.

Boyer believed that it was necessary to cut through the whole thickness of the sphincter; and instructions for performing the operation to this extent have been given by many later writers. From my own experience, however, I am satisfied that it is not necessary to divide more than the external sphincter, or merely a portion of it, together with the lining membrane of the anus and subjacent cellular substance. The most convenient instrument for the purpose is a blunt-pointed straight bistoury, which may be guided on the finger with a sawing motion to the requisite depth. The incision should be made towards the side of the gut, and through one of the fissures, if there be any present. A piece of dry lint is the only dressing required after the operation; and the wound may be treated subsequently as if it had been made for a *fistula in ano*.

The following case affords a remarkable instance of this affection. I was asked to see a gentleman about sixty years of age, who stated that, a few weeks before, after sitting out a long debate in the house of commons, he had felt extreme difficulty in evacuating the bowels, having previously for several years experienced more or less uneasiness from this source; that he had consulted a physician and surgeon in London, who prescribed laxatives without affording relief; and that his complaint had continued so as at length to confine him to bed. I proposed an enema, which was at once objected to, on the ground that the anus would not admit the smallest sized tube. Suspicion being thus excited, the anus was examined, and found to present the characteristic features of spasmodic stricture. Having explained my views of the case, I gently insinuated the narrow sheath of a *bistoury caché*, which I happened to have with me, and then expanding the blade, withdrew it, so as to make an incision at one side of the orifice. A copious stool immediately followed and the patient was at once completely relieved from his complaint.

THE END.

ON THE

NATURE AND TREATMENT

OF

DROPSICAL DISEASES:

BY JONATHAN OSBORNE, M. D.

Fellow, and late President of the King and Queen's College of Physicians in Ireland, Physician to Sir Patrick Dun's and Mercers' Hospitals, Member of the Royal Society of Quebec, of the Botanical Society of Edinburgh, &c.

INTRODUCTION.[1]

In the present edition this little work is enlarged, in order to embrace all the forms of dropsy which are usually entrusted to the care of the medical practitioner. As the treatment of this disease has been hitherto very generally conducted in a routine manner by the employment of one set of remedies, and without reference to the various affections which produce it, I have in the following pages embodied a concise account of all those diseases which are accompanied or followed by dropsical swellings; and have pointed out the different modes of treatment, which, in my experience, have been proved to be most successful.

If in my diagnosis of diseases of the heart I shall be considered by some to be far behind the advances made in this part of the subject, on account of my attaching only a secondary importance to the sounds, and my relying mainly on circumstances connected with the obstructions in that organ for the discovery of the valve affected, my reply is, that those circumstances have been to me the surest guides, not only in distinguishing the valve affected, but in leading to some more remote but not less important practical deductions. Under the article Ascites, a distinction is drawn between those cases which are the result of simple inflammation of the peritoneal surfaces of the liver, and those which, depending on alterations of structure in its substance, are in their nature obstinate, and to be acted on only by repeated and carefully conducted courses of treatment. The reader will find considerable stress laid on interposing intervals of rest, and total abstinence from the use of powerful medicines for the purpose of reinforcing the patient's vigour by appropriate means; the want of which has appeared to the author to have caused many cases, otherwise well managed, to terminate unsuccessfully.

In the account of Renal Dropsy, published in the first edition, I have nothing to alter; and am gratified at perceiving that the opinions advocated in it are very generally admitted and adopted. My subsequent experience

[1] On the Nature and Treatment of Dropsical Diseases: in Four Parts. Parts I. & II.—On Dropsies from Suppressed Perspiration and Diseased Kidney. Part III.—On Dropsies from Impediments to the Circulation. Part IV.—On Dropsies from Topical Affections. Second edition, with considerable additions. Small 8vo, pp. 134. London, 1837.

has confirmed their correctness. I have only to add, as accessory to the means recommended for procuring perspiration in refractory cases, a plan which did not occur to me till very lately, but which has succeeded after others had failed;—it is, the immersion of one of the extremities in the vapour bath for some hours every evening, and this for several days consecutively. When duly persevered in, I found that perspiration was at length induced in the one limb; and that, by continuous sympathy, it was soon afterwards spontaneously diffused over the entire surface with the effect of a complete subsidence of the dropsical swellings.

The number of cases from which the opinions set forth in this treatise have been derived is so great, that many volumes would be required for the publication of them; and in the present edition twenty-three are selected, merely for illustration of certain symptoms or effects of treatment. These pages, therefore, are not to be taken as containing the author's experience, but the results of his experience in an abridged form; and, in publishing them, he endeavours to discharge a duty to the public, which he contracted when he was placed over large hospital establishments: where as the opportunities for investigating disease have been supplied on the most extensive scale, so a corresponding value in the importance and accuracy of his observations ought reasonably to be expected.

Dublin, 26 *Harcourt Street*, 28*th April*, 1837.

PART I.

DROPSIES ACCOMPANIED BY COAGULABLE URINE, AND SUPPRESSED PERSPIRATION.[1]

It has been frequently observed, that dropsy should be considered rather as a symptom than a disease. Its occurrence in parts of the body previously sound, as a result of diseases of certain viscera, of debility, or of some impediment as to the functions of circulation or respiration, ought to have directed attention to the diseased actions believed to produce it, for information as to its nature and treatment. The classifications of dropsies hitherto adopted are about as rational and useful as would be a classification of diseases accompanied with excessive perspiration, under the title *ephidroses*. Such classifications, embracing various affections, are injurious, by investing with a name a combination which is only a mental abstraction, and which has no actual existence. The connection formed by including affections which happen to produce serous deposits, under the name *Dropsy*, has now begun to be dissolved. It is so well established that many of them arise from different and opposite states of the system, that in most cases enquiry is instituted as to the previous history of the disease; and few such affections are suffered to remain under the obscure denomination of dropsy, without some attempt being made to discover the *cause* of the serous effusion.

One kind of dropsy, however, has been suffered to remain longer

[1] From the Dublin Journal of Medical and Chemical Science. Jan. 1834.

under investigation than any other. It is not necessarily accompanied by any distinct local pain, and is not preceded by any disturbance of function, cognisable by ordinary observers, and it has been the work of many years to trace it to a diseased state of the kidneys. The first careful examination of the urine in dropsies was instituted by the late Dr. Wells. To him succeeded Dr. Blackall. Both these observers perceived that, in a great number of dropsies in which the urine coagulated by heat, there was evidence of inflammatory action, and that in such cases bleeding was productive of very marked benefit. Hence arose the class of dropsies designated inflammatory: and the practice with respect to these was much improved, and rendered more successful, by combining bleeding with diuretics; to which latter class of medicines the treatment had been hitherto exclusively confined. In addition to the cases adduced by Dr. Blackall, we have those recorded by Dr. Crampton, in the Memoirs of the Association, which prove the benefit derived from bleeding in some cases, which, until this mode of depletion was practised, were progressively approaching a fatal termination. Here, however, the enquiry rested, till Dr. Bright made the important observation, that coagulable urine was connected with a diseased state of the kidneys. Since the publication of his work, Drs. Gregory and Christison have brought before the public large collections of cases and dissections, which all bear testimony to the truth of Dr. Bright's observation. The cases of urine coagulating by heat, recorded by Drs. Christison and Gregory, were eighty-seven in number; and amongst those the granular deposit in the kidneys was always detected when examination after death took place. When these cases are added to the series of cases described by Dr. Bright, it must be confessed that they form a body of evidence to fix the pathology of an obscure disease, which merits the most serious consideration, in order to decide on the affirmative or negative of the proposition which they appear to establish. And yet, what has been their reception on the part of the profession? A few statements were made, which, even if taken in their full extent, are inconclusive, and the truth of the discovery has been obscured by doubts and hesitations, rather than controverted by facts or arguments. The facts produced in opposition, so far as I have been able to collect them from the article *Dropsy* in the Encyclopædia of Practical Medicine, and from Dr. Copland's Dictionary, are the following:—

1st. That coagulable urine has occurred in adults who appeared to enjoy good health, and also in children.

2nd. That in some persons it can be produced by taking pastry, or other indigestible articles of diet.

3d. That Dr. Darwall has adduced an instance of a woman who died from disease of the heart, and in whose lungs there were scattered tubercles, in whom the kidneys were found in Dr. Bright's first stage of disease, although the urine did not coagulate.

We shall consider these statements in their order:—

1st. The continuous secretion of coagulable urine by an indi-

vidual, who, notwithstanding, remains in the undisturbed possession of health and strength, would prove, either that the secretion was not the result of disease, or that, if so produced, the disease must be unimportant, and inadequate to the production of any sensible disturbance of the functions. Whether such an instance as this can be produced or not, it is impossible for me to say; but I may be allowed to state, that in a considerable number of trials I have not found one example; and experience enables me to assert, that many instances may be found of coagulating urine, which appear to be cases of health, but which an attentive examination would prove to be connected with disease. I may adduce, as a specimen, the case of a young man, who, about a year ago, had palpitations, and œdematous swellings, for which his medical attendant prescribed bleeding and other remedies, with good effect, and then sent him to the country for the restoration of his health: he was lately brought to town, preparatory to the resumption of his ordinary avocations. He made no complaint, the palpitations and swellings no longer existed, and he believed that all his ailments were at an end: but the eye of his anxious mother perceived that there was still something wanting to perfect health, and he was submitted to my examination. His appearance was healthy, his appetite and sleep natural, and the only circumstance which affected him was an anxiety as to the motions of his heart, in consequence of the opinion which his former attendant had entertained, of its being the seat of an organic disease. The heart's action, however, was natural: there remained then no complaint. I requested that a specimen of his urine should be brought, and, on observing its pale and cloudy appearance, tried it by heat, and found it to coagulate. Hence was opened a new field of enquiry; and it appeared that this young man, who, to a superficial view, would have appeared healthy, had a sensation of a dull weight in his loins, was in the constant habit of passing troubled urine, with dense mucous clouds, had dry skin, which never perspired except after the most fatiguing exercise, and altogether afforded complete evidence, that the kidneys were in the state which has been described by Dr. Bright.

It is true that in fevers, and other inflammatory diseases, an albuminous deposit is obtained on adding a saturated solution of corrosive sublimate. This urine is high coloured, and abounds in urea, yielding abundant crystals when treated with nitric acid, without requiring any previous evaporation. No coagulation, however, is effected by heat, unless it be so long continued at the boiling point, as to evaporate a large proportion of the water. There are also some individuals, who secrete constantly urine of this description, and in whom it may be traced to a habit of drinking very sparingly, by which a concentrated urine is produced. That a greater quantity of albumen in the urine is required to produce coagulation by heat, than by corrosive sublimate, is manifested by the following experiment:—I procured some urine secreted by an individual under these circumstances, which threw down an abundant coagulum to corrosive sublimate, but not to heat; and I found

that an addition of a fortieth of its quantity of serum caused a cloudiness barely perceptible, a considerable time after it had commenced boiling, and that nearly twice that proportion was requisite to enable it to form a coagulum. Thus it appears, that such a proportion of albumen as may coagulate with corrosive sublimate, may be consistent with health, but that the quantity producing coagulation by heat is so much greater, as to require a diseased state for its production.

The albuminous urine observed in children is very probably of frequent occurrence, which yet does not diminish the importance to be attached to it in the case of adults. The urine of children is at all times different from that of adults, in the proportion of its constituents. The quantity of urea and of uric acid is much less; and those are the deficiencies which are usually connected with albuminous urine in the adult. Hence we must not admit the value of albuminous urine as a symptom of a certain disease in the adult, to be diminished by the fact of the same being often secreted in infancy. The secretion is so different, that what is healthy in the adult would be esteemed morbid in the child, and consequently no comparison can be instituted between them.

2d. Here, however, we are met by the alleged fact, that certain healthy individuals are able, at any time, to produce a secretion of urine, coagulable by heat, merely by taking pastry, or certain other indigestible articles. Now this fact, if worth any thing as an argument, amounts only to this :—" Coagulable urine is not an indication of the presence of a certain disease of the kidney, because it may be produced by eating indigestible substances." In this proposition it is assumed, first, that the transient appearance of coagulable urine is the same thing as the continuous secretion of it, which alone constitutes the indication of the organic change of the kidney, of which we are treating; and, secondly, it assumes that this pathological phenomenon can only be produced in one way; and that, by showing that one way, it is proved impossible that it can be produced in any other. According to this mode of reasoning, we might prove that tenesmus is not an indication of dysentery, because it can be produced by aloetic purgatives; or that coma is not a symptom of apoplexy, because it can be produced by drinking spirituous liquors.

3d. Dr. Darwall's case of uncoagulating urine, in connection with the first stage of diseased kidney, as described by Dr. Bright, carries no weight as an objection. The first stage of the disease is with difficulty distinguished from the natural state, and is most likely to be confounded with, and appears almost identical with that paleness of the kidneys, spleen, and liver, which occurs in scrofulous cases. And this was evidently a scrofulous case; as appears from the presence of tubercles in the patient's lungs, as stated by Dr. Darwall.

Those are all the adverse facts which I have been able to collect. But I find, with regret, that by some this important discovery has not been resisted by facts, but depreciated by loose observations,

which deserve animadversion, when we consider the injurious effect which such may exercise on the progress of medical science, not so much with reference to this individual question, as to the investigation and settlement of medical questions in general. The truth of the statements made was not impugned; the extent of the field of observation—Guy's Hospital, and the Royal Infirmary of Edinburgh—has not been denied; the number of the observations recorded must have been admitted to be greater than has, within many years, been brought to bear distinctly on any one individual proposition in medical science. And yet all these circumstances were dismissed with the trite remark, that *further observations are required;* a remark which is as applicable to the discovery of the circulation, as to the question before us. By this remark we might throw an air of doubt over the best established propositions. It is so easily made, and, withal, so true when applied to every subject, that it is impossible to prove its impropriety. To this, however, has been joined the observation, that the writers, and the writers' friends, have not had opportunity to observe the connection, and, therefore, they do not only disbelieve it themselves, but call upon others to do so, without producing a *scintilla* of evidence whereon to ground our disbelief, except the fact that *they* have not had, or have not availed themselves of, the opportunities of examining the question by the test of a sufficient number of experiments. This must forcibly remind us of the village lawyer, who, when his client had been convicted of stealing a sheep, by the positive testimony of three witnesses who saw him steal it, replied, that that evidence went for nothing, inasmuch as he could produce many more credible witnesses who did not see him steal it. Thus, because those gentlemen have not seen the connection between coagulable urine and diseased kidney, we are not to be permitted to credit the evidence of those who have seen it; and all the facts before us,—the result of long and laborious enquiries on this subject,—are to be dismissed with the unmeaning, because universally applicable aphorism, that *further observations are required!*

The number of cases of coagulable urine which came under my notice, and the details of which, for reasons stated in the introduction, I have determined to omit, was thirty-six. Of this number examinations after death evince the disease of the kidneys in nine cases; while the remaining cases prove the existence of the same disease, so far as it is susceptible of proof, by similarity of symptoms, of cause, of collateral circumstances, and of *adjuvantia* and *lædentia;* and I can with truth aver, that I have witnessed many more cases which are not sufficiently detailed for the present occasion, but which, without any exception, corroborated the truth of Dr. Bright's proposition. The negative evidence in my possession is too copious to be detailed. It is, however, decisive as to the question at issue. It consists of numerous cases of dropsies, connected with diseased liver, impediments of circulation, or respiration, or general debility, which terminated fatally, in which the urine was examined before death, and found not to coagulate, and the

kidneys were found to be free from disease; also cases ending fatally, but unconnected with dropsy, in which the kidneys were healthy, and the urine did not coagulate. This evidence appears to me peculiarly valuable, inasmuch as during the last three years I have anxiously sought for every opportunity of examining the kidneys of every individual in whom the urine had been examined during life; and in no one instance have I met with coagulable urine without diseased kidneys, or healthy kidneys with coagulable urine. When I take this, my personal experience, in connection with the great number of cases recorded by Drs. Bright, Christison, and Gregory, very few even of the most generally admitted facts in pathology appear to be grounded on such a body of evidence. I have had under my care one case which may be esteemed an exception: in this the urine was rendered slightly turbid, and threw up a froth when heated to the boiling point. On dissection, the peculiar granulated structure was scarcely discernible; but one of the kidneys contained within its proper tunic, at its posterior surface, a mass of cancerous structure, presenting fungus hæmatodes, scirrhus, and medullary sarcoma, altogether about the size of half an orange. This mass did not extend to the pelvis of the kidney, but was closely connected with both the cortical and tubular structure, from which it was difficult to separate it without causing a rupture of the adjacent parts. This occurred in a case of chronic bronchitis and emphysema, terminating in œdema of the lungs, and was unaccompanied by any complaint of pain or uneasiness in the part. In the other kidney there was an unusual hardness of the mamillated extremities of the tubuli, and an indistinctness in the striæ, exhibited by them on a transverse section; the cortical structure of this kidney being very little altered from its usual appearance. In this case the slight coagulation was probably produced by the cancerous disease now mentioned, which, being closely connected with the interior of the kidney, caused irritation, and consequently a morbid secretion.

Some other combinations of circumstances deserve to be noticed. In a case of acute nephritis, in which both kidneys were filled with abscesses, and in which the urine contained a purulent deposit, there was no coagulation by heat; hence (so far as one case can prove) it appears that coagulation does not belong to suppurative inflammation of the kidney. In another case one kidney was filled with abscesses, and the other contained the gray granulation. In this case the urine corresponded to the state of both kidneys, by presenting a purulent deposit, and also coagulating. In a third case the substance of one kidney was entirely absorbed, being almost reduced to a bag, formed by its investing membrane and pelvis, in consequence of tumours formed within its ureter, which prevented the passage of the urine into the bladder, and by pressure caused absorption of its substance; whilst the other kidney was enlarged to double its natural size, and deformed in shape by a large deposition of the gray substance: and in this case the urine was light coloured, and coagulated.

It appears from the experiments of Dr. Christison, that the urine in those cases is of less specific gravity than healthy urine, and that the urea is always diminished; the quantity rarely exceeding one-half, and in some cases amounting only to a fifth of that in health, whilst he, at the same time, has proved its existence in the serum of the blood. This is confirmed by the observations of Prevost and Dumas, who found, in their experiments on animals, that when the kidneys were extirpated, urea appeared in the blood; thus proving that this substance is not *produced*, but merely *eliminated*, by these organs. When an injection is thrown into the artery, even in the most successful manner, it will not penetrate into the grayish deposit. The cortical portion of the kidney is the chief seat of the deposition; yet we sometimes find it filling up, and encroaching so much on the other part, that the tubular portion is limited to small, insulated portions; and in these cases the tubuli increase in density, and become more confused together, the nearer they approach their termination in the mamillated processes. In some of the most acute cases I found the lining membrane of the pelvis and upper portions of the ureters in a state of the highest vascularity, resembling crimson velvet. The changes produced on the size of the organ are remarkable, and in my observations appear to follow this rule, —that, in the more recent cases, the kidneys are enlarged beyond the natural standard; while in long confirmed cases they are reduced in size, and become hard in proportion; the cortical structure appearing to be removed, and replaced by the gray deposit.

The examination of the urine in this disease must be conducted according to one fixed rule, otherwise we shall constantly meet with apparent contradictions. The urine should be that which is passed in the morning before breakfast. It should not be examined till it has cooled. It then is usually of a pale citrine colour, semi-transparent or translucent, but not transparent like healthy urine; and at the bottom of the vessel there is an opake, whitish cloud, consisting of the mucus of the urinary passages, and differing from healthy mucus by its greater density and opacity; while in other cases it differs from the healthy state by containing no mucous cloud. On heating this urine, in a spoon, over the flame of a candle, white coagula are formed in those portions of the fluid next the metal, long before the heat has advanced to the boiling point: and when the heat is continued afterwards, the coagula become more firm and distinct. The lesser degrees of coagulability are signified by its not taking place till the fluid has boiled, or till some of it has been evaporated; by no coagula forming, and the fluid being rendered merely turbid; and, lastly, by throwing up a froth when boiled, which appears to be produced by the smallest quantity of albumen that can satisfactorily be tested by heat.

I may here mention, incidentally, that I use this mode of examining urine in other diseases beside dropsy, and without any expectation of meeting albumen. When urine with a copious sediment occurs, and it is desirable to ascertain whether it consists of uric acid and the urates, or of the earthy phosphates, I pour off the clear

urine, and heat in a spoon the sedimentous urine which remains at the bottom. If the sediment consist of uric acid and the urates, it becomes perfectly clear before the heat is raised to the boiling point; and the sediment is restored to exactly its former state on cooling. If the sediment consist of the earthy phosphates, no such changes can be produced.

The quantity of urine in this disease is variable, being not remarkable for scantiness, as is the case in other dropsical diseases. On the contrary, in most cases it is nearly equal to the drink, and in some cases exceeds it, approaching in this respect to the diseased secretion of diabetes.

The state of the skin is one of the most important facts connected with the disease. In all my cases perspiration was extinct, except in a few in which it occurred in the head, or in a transitory manner in the palms of the hands. When the perspiration was restored, in every instance a removal of the dropsical swellings immediately followed. As this part of the subject, however, leads directly to the plan of treatment which I have to recommend, and which differs from that hitherto adopted, I shall postpone this, along with the consideration of the other symptoms of this remarkable disease, to the next opportunity.

PART II.[1]

On a former occasion I stated the facts which appeared to me to prove that albuminous urine, when continuously secreted, ought to be considered as a symptom of disease of the kidneys. Since that time I have continued to enjoy the same opportunities of observation as before; and, though I have anxiously sought for evidence, either adverse or favourable to this opinion, I have not met with a single instance of urine coagulating in a constant manner, in which an opportunity of examination after death was afforded, that did not present the disease of the kidney; nor, on the other hand, an instance of the disease being found in the kidney after death, in which, on taking a specimen of the urine in the bladder, it did not coagulate. On a review of the notes of all the fatal cases I am also enabled to state, that the extent of the disease discovered after death has been, in every instance, in proportion to the degree of coagulation. Thus, when the urine only frothed on the application of heat, the kidneys, although gorged with blood, contained the gray, granulated structure exclusively in the outer portions of the cortical substance, and especially at the extremities of the gland; while in cases of complete coagulation, the entire cortical substance was filled, or rather superseded, by the deposition now mentioned, and

[1] Read before the College of Physicians, January 18, 1835.

the tubuli were both compressed and rendered indistinct. In some of the cases which have last occurred, I have also to mention that the emulgent veins were filled with a substance resembling the buffy coat of the blood, but of a curdy texture.

I wished to pause before bringing forward this second part of my observations, in order to be enabled to ascertain the precise effect of several remedial agents. I was much surprised to find that this disease, which last year and in former years had been so frequent, had now become comparatively rare; and consequently a greater delay took place than I had anticipated. During this summer and autumn, however, it has been nearly as prevalent as formerly. The fact appears to be, that chronic as well as acute diseases take place more in consequence of peculiar changes in the atmosphere, than from any other agency acting on our organisation. They, like acute diseases, occur epidemically, but move as it were in a larger cycle, and cannot be observed in a limited space of time; and hence their epidemic character has escaped notice. Those who have the charge of large hospitals will, however, be able to recall to their recollection periods in which chronic rheumatism, dropsies, chronic bronchitis, or diarrhœa, prevailed, as well as those which were signalised by the simultaneous occurrence of acute diseases.

I have been favoured by a communication from Dr. Barlow, of Bath, referring to a paper on dropsy with coagulable urine, published by him in the *Midland Medical and Surgical Reporter*, in May, 1832, which I regret not having seen. He has no doubt of the general truth of Dr. Bright's conclusions, and has considered him to have established the fact of a connection subsisting between organic disease of the kidney and coagulable urine. I am happy to bring forward, from so eminent a practitioner, this additional evidence, of which I was not aware when I wrote the first part of this paper. Dr. Barlow has had the kindness to mention the particulars of a case which appeared to him one of albuminous urine arising from a derangement, *only functional*, which I shall give in his own words:—"One of the earliest and most remarkable cases of the acute kind that I have met with, occurred in a hale, active man, who became a patient of the Bath United Hospital in May, 1830, for extensive dropsy of a highly inflammatory kind. The urine, when first tested in this case, coagulated by heat alone into a solid mass. By active treatment he got well, and was discharged in July. This man, a common labourer, has continued well ever since—in constant work; to which he would hardly have been equal, if organic disease of the kidney, such as Dr. Bright has described, had remained."

With the utmost deference to very high authority, I conceive that the above case is an instance of *merely functional disease*. The continuous morbid secretion, always presenting the same difference from the healthy state, and accompanied by effusions into the cellular texture, are evidences of *a change, not fugacious, but permanent;* and when the cure of such a case is obtained, there is as much evidence of an organic disease being cured, as when a

hepatitis, or gastritis, is brought to a successful conclusion. Although the highest acknowledgments are due to Drs. Bright, Gregory, and Christison, by whose extensive collections of facts, and laborious investigations, the connection between albuminous urine and disease of the kidney was first ascertained, (a connection which previously had been barely suspected,) yet the fact which they have established has not been at all examined with reference to the influence which it ought to have on the treatment of the disease, and has hitherto remained unproductive. In those cases, the urine differs from that of health, by the presence of a considerable portion of albumen, and by the deficiency of urea. The quantity of the secretion, however, is variable, being more frequently in the healthy proportion to that of the drink than diminished. This last circumstance, occurring in a great majority of cases, first led me carefully to observe the perspiration, and the state of the skin. The result of my observations has been, that this peculiar disease stands in an intimate relation with the suppression of the healthy discharge from the skin, its connection being so constant, that they may be fairly presumed to stand in the relation of cause and effect.

The force of the circulation in this disease appears to be depressed by the action of some specific agency not as yet ascertained. The surface and extremities are uniformly cold—the latter being either livid or pallid; and, on reviewing my collection of cases, I find that in all of them the pulse was low, undulating, and ranging from sixty to ninety, except when they were complicated with inflammations; and that in those cases it was considerably less frequent than usual.

The perspiration was either completely extinct, or confined to occasional breakings forth in the head or chest, the palms of the hand, or soles of the feet. The skin was dry and shining, harsh to the touch; and, on examining it with a lens, the usual eminences belonging to the orifices of the follicles were no longer to be found, and the orifices themselves were hardly perceptible, except when they appeared like black dots, in consequence of being filled with the residue of old secretions.

Whenever general perspiration came on, either spontaneously, or in consequence of medicine, then the cases always terminated favourably.

The suppression of the cutaneous discharge must be attended with important changes, if we consider merely its quantity as determined by several observers. And although there is a great difference in the results of their observations, yet they ought not to be passed over in our estimation of this, the most remarkable and most uniform circumstance connected with the disease.

According to Dr. Bryan Robinson, of this city, the perspiration is to the urine as 1340 to 1000 in youth, and as 967 to 1000 in old age.

Sauvages, who resided in the south of France, found that from sixty ounces of ingesta, were passed off five ounces of fæces, twenty-two ounces of urine, and thirty-three of perspiration.

Gorter, in Holland, assigned to the excretions nearly the same proportions; while Dr. Keill, of Oxford, found the perspiration to be less than the urine in the proportion of thirty-one to thirty-eight. This, however, was objected to by his cotemporaries as being the result of a too liberal allowance of wine, the diuretic effect of which is well known. According to Linnings, who made his observations in South Carolina, the perspiration exceeded the urine during the five warmest months of the year, but was exceeded by it during the seven coldest. In all these observations it was proved that the perspiration was most abundant in youth, and the urine most abundant as old age approached.

While those observations are sufficient to show the average proportion of superficial exhalation and of urine, in a state of health, they are incomplete in not determining the proportion of exhalation of the lungs, as distinguished from that of the skin. This latter deficiency was supplied by the experiments of Lavoisier and Seguin. These were principally performed by placing an individual in a bag of gummed silk, accurately fixed round his mouth. The difference between the ingesta and the sum of excretions, and the weight acquired by the bag, gave the amount of pulmonary exhalation. This experiment was varied in different ways; and the result was, that the cutaneous was to the pulmonary transpiration as eight to five. Although it is much to be desired that those experiments should be repeated, and although, even in the most skilful hands, much diversity of result would be the necessary consequence of the difference of temperature, of age, and of constitution, yet enough has been ascertained to prove that the fluid which is thrown off by the skin, in health, is to the urine, on the average, as ten to eleven. If the quantity of the cutaneous discharge is imperfectly ascertained, its chemical analysis is no less a desideratum. It is known to be decidedly acid, and to contain most of the fixed salts which are found in the urine; and when the water of it has evaporated, it leaves a deposit which is irritating to the skin, and in hot climates creates a necessity of constant ablution and change of apparel, in consequence of the acrimony which it acquires by heat. The sudden repression of this secretion in any given part of the body, is usually followed by an inflammation or excitement of some organ, or peculiar system of organs, according to the peculiar temperament of the individual. Thus cold water, long applied to the feet, will produce in one, inflammation of the conjunctiva, in another, bronchitis, and in a third, diarrhœa; or a partial draft of cold air, blowing on the neck, will cause in one cynanche, in another, inflammation of the schneiderian membrane, and in a third, rheumatism of the muscles of the neck, according as the individual has been rendered liable to these affections by previous attacks of them, or by peculiarity of constitution. When cold is applied over the whole surface in a continuous manner for some time, and no inflammation or general fever has resulted, then an increased secretion from the kidneys is usually observed, and the necessity of frequent evacuations of the bladder, during the

frosts of winter, has become proverbial, and is familiar to every one. When the suppression of the perspiration, however, instead of being transient, is rendered permanent, then permanent irritation of the kidneys is produced, and in the great majority of cases the result is the disease of the kidneys now before us; while in some comparatively rare instances, diabetes, and in others more numerous, chronic diarrhœa, with bronchitis, are the consequences.

On reviewing the causes of the disease in thirty-six cases, in twenty-two individuals it could be directly referred to suppressed perspiration. One of these was Thomas Leahy, a remarkably vigorous man, in his thirty-fifth year, of sober habits. It appears that he was inconvenienced by the excessive perspiration of his feet, and that, at the suggestion of a friend, he wore fuller's earth in his shoes in order to repress it. The effect was immediate. The perspiration ceased not only in his feet, but also in every part of his body. Diarrhœa soon came on; and, when this was subdued by appropriate remedies, universal œdema, with coagulable urine, succeeded. Although, under the treatment adopted, the œdema was removed, yet the healthy action of the skin was never restored, and I am informed that his dropsy returned. In another of those cases, the commencement of the disease was attributed to cold bathing; but the most frequent cause of it was remaining in wet clothes. As the excitement consequent on the suppressed perspiration takes place in the secreting portion of the kidney, and neither in the *tubuli*, nor in the membranes, no acute pain is perceived; and the patient is usually barely sensible of a weight in the loins, or of a thrilling sensation shooting down the thighs. Hence has arisen the obscurity which has attended the formation and establishment of this organic disease. The next frequent cause is the abuse of diuretic drinks and medicines. Of the thirty-six cases, ten occurred in confessed drinkers of ardent spirits. One of these was able to follow his trade, until the circumstances attending the fire at the Custom-house afforded him an opportunity of indulging his passion for liquor. After drinking whiskey out of his hat to an extent which he was unable to define, he lay on the ground in a state of insensibility till late on the following day; and in addition to dry skin, and urine frothing by heat, he exhibited a complication of ulceration of the larynx, enlargement of the liver, and violent neuralgia of one of the frontal nerves. Yet in this individual the perspiration was restored, and he was freed of the œdema, and much relieved in all other respects. The confessed drunkards in my list of cases are limited to ten; but if we could ascertain the truth respecting the mode of life of all our patients, there is no doubt that many more would have been added to this number.

Diuretic medicines also have appeared to me to be a frequent cause of the disease. Squills and diuretic salts, although of the utmost importance in many affections of the thorax, yet when long continued, as they often are after the true indications for their use have ceased, become the means of bringing such on again, by

producing over excitement of the kidney, and this disease as a consequence.

With regard to the influence of other diseases. Of the thirty-six patients, four were scrofulous; three laboured under pericarditis; and three under valvular disease of the heart. This last connection has been placed in rather a prominent point of view by Dr. Bright. In my cases, the two diseases appeared to be combined only by both being the result of one cause, namely, suppressed perspiration; and a great number of valvular diseases of the heart have occurred to me without any disease of the kidney, except the usual deficiency in secreting power; which, as a necessary consequence of impeded circulation, comes on towards the fatal termination of such diseases.

Of the thirty-six cases which came under my notice, two originated in the remarkable influenza which visited us in the spring of 1833. That epidemic was distinguished from most others by the following circumstances:—1st, The copious discharge of urine, which was observed in almost every instance, from the commencement to the termination. 2dly, The remarkable debility. And 3dly, The permanently pallid complexion which succeeded, and which in many young persons has continued, and thus deteriorated their appearance since that time. From those circumstances, it is to be apprehended that many of the cases of impaired health, which commenced after that influenza, were connected with suppressed perspiration, and that in them this peculiar disease of the kidney established itself. Besides the two cases now mentioned, I ascertained, in three or four cases of paleness of countenance after that influenza, that although unattended with swellings, yet the urine frothed on the application of heat.

Of the thirty-six patients, eighteen laboured under bronchitis, in different degrees of intensity; eleven had gastro-enteritic inflammation, denoted by thirst, vomiting, or diarrhœa; and the two diseases were, in six instances, combined in the same individuals. Thus it appears that nearly two thirds of the entire number laboured under inflammation of the mucous membranes. It is also to be observed, that in every case, before improved by treatment, the appearance of the mucus in the urine was such as belongs to irritations of the bladder and urinary passages, not forming a transparent cloud in the lower part of the vessel, as in health, but collected into dense opake flakes, and, for the most part, resting flat on the bottom of the vessel. The coexistence of those affections with the disease in question is best explained by this circumstance—that they are all the effect of the one cause, namely, *obstructed perspiration.*

The fatal cases amounted to nine; and of this number, four were amongst the confessed whiskey drinkers.

The mode in which death takes place, when the disease is not disturbed by complication with other diseases, is interesting, not only to the pathologist, but to the practitioner, who is thereby

warned of the fatal tendency of certain symptoms which otherwise should be disregarded. In almost all my fatal cases, when not complicated, it terminated life by the production of a low form of arachnitis; as was evinced by examination after death. This brought to light opacity of the arachnoid and fluid in the ventricles; the medullary fibres of the brain, however, being unusually firm and distinct. The invasion of this form of arachnitis was announced in the case of John Smith, (who laboured under pericarditis, with copious effusion into the pericardium,) by indistinctness of vision and moaning during sleep, by gradually increasing somnolence and depression of spirits; and on the day preceding his death, he had several seizures of general convulsions, and remained in a state of stupor during the intervals.

In the case of Anne Doyle, there was a large effusion into the right cavity of the thorax. About three weeks before death, she began to complain of sounds in her ears, resembling the ringing of bells. Although appropriate means were used to relieve the head, yet fits, with foaming at the mouth, insensibility, resembling that of epilepsy, and violent pains at the vertex, continued, with intervals, to her death.

In the case of John Hacket, aged five years, who also laboured under enteritis, and in whom were found several knots of *intersusceptio* in the intestines, death occurred suddenly, but was preceded by convulsive contractions of the right arm; and, in addition to opacity and adhesions of the arachnoid and fluid in the ventricles, there was a softening of the surface of the anterior convolutions of the brain.

In the case of Thomas Caffray, who had been relieved of the œdema, and of the most urgent symptoms of chronic bronchitis and emphysema, an imprudent exposure to cold, and subsequent excess in spirituous liquors, were immediately followed by diarrhœa and delirium; the function of respiration being nearly unaffected. Within three days from the invasion of those symptoms, he was found dead in his bed, having walked about the ward in a delirious state within a few hours of his death.

In the case of James Brown, who also suffered under pericarditis, the fatal event was preceded by a stupor of two days' duration.

In two cases, which came under my examination since writing the above, the patients sank under a low form of peritonitis, which came on a few days before death. Those instances show the tendency to inflammation of the serous membranes, which the disease always produces, and which has been attributed to the acrimonious principles of the urine being no longer eliminated from the kidneys, and consequently communicating to the blood the property of irritating the more sensitive structures through which it is circulated.

Death took place in Catherine Reilly and Miss E., both scrofulous cases, from general debility; in James Kenny, from bronchitis; and in Catherine Kavenagh, from pneumonia, with broken down structure of the lung.

Thus it appears, both from the causes as related in the history

of the individual cases, and from the average number of the accompanying affections, that this disease is connected more especially with suppressed perspiration than with any other known agency; but that it may also be produced by excitement of the kidneys from spirituous liquors.

Subsequent observations have convinced me that it is produced *in the most decided manner by a combination of both*, as when an habitual drinker is exposed to a long continued application of cold.

We now proceed to the consideration of the treatment.

A kind of dropsy was observed by Frank (de hom. curand. morb. S. 153), characterised by no deficiency nor depth of colour in the urine, and with a tendency to diarrhœa, which he found to be more than ordinarily difficult to cure. In this we recognise the peculiar disease before us, and, at the same time, its obstinacy to the old method of treatment. My attention was first directed to the peculiarity of the treatment required in this disease, by observing that certain diuretics, when their use was long continued, not only failed in producing increase of the urine, but were followed by a marked diminution, almost amounting to a suppression of that secretion. Having obtained possession of this fact, I separated the histories of the cases in which it occurred, and found them all to agree in presenting coagulable urine. Some few dropsical cases, without coagulable urine, in which diuretics did not take effect, certainly occurred; but these were connected either with impeded circulation, or extensive visceral affections. In such, *all* the secretions were impeded, and therefore they did not disturb the truth of the general proposition.

When I attentively considered the cases of dropsy with coagulable urine, published by Dr. Gregory, I very unexpectedly found them to coincide with my observations. On examination of them, as recorded in the *Edinburgh Medical and Surgical Journal*, it will be found that the most remarkable diminutions of the secretion of urine occurred after the administration of squills and cream of tartar; while in other cases, in which the treatment was principally confined to bleeding and purgatives, the greater proportion of success was obtained. And without meaning, in the slightest degree, to detract from the merit of the several physicians who treated these cases, the necessity of bringing forward the truth relating to the subject now before us, compels me to state the fact, that of their patients, amounting to eighty, forty-five died, being above one half; whilst among the thirty-six cases which I have treated conformably to the views which I have endeavoured to explain, there were only nine deaths, being one fourth.

When a patient was placed under my care, with general œdema, coagulable urine, and dry skin, I directed him to be kept in bed, in order to maintain warmth of the surface, which is usually disposed to be cold. It has happened frequently that, by external heat alone, an improvement, both in the quantity and quality of the urine, and a material subsidence of the œdema, have taken place. The first medicine ordered was usually a purgative; and in the choice of

this, in order to avoid ambiguity as to its mode of action, I abstained from the use of all those articles which are reputed diuretic—such as compound of jalap, or supertartrate of potash; and I generally employed the senna mixture. I then commenced a diaphoretic course, by administering foot baths, hip baths, or general baths; the last either of water or of vapour, according as they appeared to agree best with the individual case, at night at the hour of going to bed.[1] The patient also took at night, eight grains of pulv. jacob. ver. 4. of pulv. ipecac. c. opio, and ten grains of confect. aromat.

The usual drink was barley water. In case, however, of tendency to stupor, or headache, the Dover's powder was omitted, or given in smaller doses. In one case, in which no perspiration was produced by the above and other means, it followed the use of the following mixture:—R. Aq. acet. ammon. ℥iv., sulphur, subl. ℥j., vini ipec. ℥j., ext. opii aq. gr. ij., aquæ fœnic. dulc. syrup. sacch. empyreumat.[2] utriusque ℥ij., one ounce to be taken every hour.

When the vapour bath was not attended by perspiration, from want of reaction on the part of the patient, he was directed to take, while in it, two drams of tinct. guaiaci ammoniat; when, however, (as sometimes happened,) both vapour and water baths produced coldness of the extremities, they were discontinued. It is to be observed that the drops of moisture which are condensed on the surface of the patient's body, while in the vapour bath, are often mistaken for perspiration. The occurrence of the latter can only be determined by ascertaining if the skin becomes moist after the patient has returned to the bed, which should, in every case, be warmed for his reception.

When there was a continued tendency to coldness of the surface, unaccompanied by feeble action of the heart, the diaphoretic preferred, was tinct. guaiaci. ammoniat. ℥ij., sulphuris loti ℥j., mist. camph. oz. j., sp. piment. ℥ss.; or the following,—R. carbon. ammon. ℥ss., mist. camph. ℥vj., an ounce to be taken every two hours. In connection with these remedies, administered in the evening, with a view to procure a perspiration during the hours of sleep, warm applications were kept up during the day, and frequently a succession of bags of hot salt was maintained, when the heat of the extremities could not be otherwise preserved. When perspiration was restored in one part of the body, as in the trunk, but not in the limbs, the latter were rubbed several times during the day with an infusion of two drams of bruised mustard seed in

[1] I have seen that some practitioners prefer the employment of warm baths in the morning. But surely the less liability to cold, the greater tendency to perspire in every individual at night and during sleep, render the hour of going to bed the most expedient.

[2] The peculiar properties of treacle are better known to the common people than among the faculty. It is a popular remedy for cold, and when taken in quantity is a powerful diaphoretic, as I have often experienced. I know a healthy individual who cannot take more than a few tablespoonfuls of it, without undergoing a profuse perspiration.

distilled vinegar, with naphtha,[1] or some other suitable stimulating embrocation.

Having never failed in removing this kind or general dropsy, *whenever the entire surface of the body was restored to a perspiring state*, it is not surprising that I should bestow the utmost attention on this part of the treatment. In a great number of cases, and especially those connected with bronchitis, the patient took, three times daily, an ounce of the following mixture :— R. balsami copaiba, ʒj., gum Arab., ʒiijss., sacch. q. s. ft. emulsio. adde aquæ cinnamomi mist. camph. utriusque, ʒij. The use of this was first suggested by the appearance of the mucus in the urine, which in almost every case denoted irritation in the urinary passages ; and in chronic bronchitis, with scanty and opake secretion, there is no more valuable remedy. Copaiba has been set down in the Manual of Materia Medica as a diuretic; but I never recognised this effect from it, except through its agency in diminishing irritation in the urinary passages. When given to patients who were kept under the influence of external heat, it always acted as a diaphoretic, and was peculiarly valuable in answering the indications usually coexisting in those cases.

Next in importance to the restoration of the function of the skin, and, indeed, in most cases expedient, as contributing to that great object, was blood-letting. It will be recollected that, in Dr. Blackall's work, and in the papers by Dr. Wells, and by Dr. Crampton, before the disease had been as yet traced to the kidneys, there was a considerable body of evidence to prove the advantage of bleeding in cases of dropsy with coagulable urine. The circumstances which appeared to me to afford the strongest indications for general blood-letting, were, 1st, the peculiar full and undulating pulse, which resembles that so commonly occurring in nephritis ; 2dly, the coexistence of inflammation of other parts ; 3dly, pain or weight in the region of the kidneys; 4thly, the appearance of blood in the urine. The blood drawn was not usually buffed ; but the serum, in almost every case, was turbid, and especially, but not exclusively so, when the bleeding was performed within a few hours after a meal. In some cases, cupping or leeching over the loins was resorted to, when there were some of the indications now mentioned ; but when general blood-letting was forbidden by general debility, or other circumstances. Counter irritation over the region of the kidneys is a practice which requires some caution in a disease attended with such languor of the capillary circulation, and in which there may often be danger of the formation of intractable ulcers. Yet the application of moderate-sized blisters to the loins is a very suitable irritant, and calculated to

[1] This liquid, (also known as pyroxylic spirit,) which is sold at the druggists, is highly volatile, and has a peculiar penetrating odour, to which the patient generally becomes reconciled. Its vapour has appeared to me to be advantageous in the cases of chronic bronchitis, with which this disease is so generally combined—the odour may be modified by the addition of camphor, ʒj. to the ounce.

promote the action of the diaphoretic medicines. The best mode of applying these is by lint, steeped in tincture of cantharides, and covered with oiled silk. This has the advantage of superior cleanliness, of quicker action, and of not tearing the cuticle. Those vesications may be dressed with iodine ointment,[1] or be healed rapidly by means of simple dressing, and thus a rapid succession of irritants be maintained.

With regard to purgatives: in many cases they were withheld, in consequence of the tendency to diarrhœa, which is so commonly observed in this disease. When purging, however, by the aid of medicine was required, those most frequently employed were the senna mixture, castor oil, or rhubarb and magnesia. It is probable that in some of my cases other purgatives, such as gamboge, jalap, or crystals of tartar, might have been administered with considerable advantage; but I refrained from them for the reason before stated. In the management of those cases, purgatives should never be allowed to interfere with the administration of diaphoretics. They should, therefore, be given early in the morning, in order that their operations may be terminated before the patient is placed under the effect of the diaphoretics in the evening.

Calomel was administered in large doses, when affections of the head came on. These, however valuable in rescuing the patient from a state of approaching coma, were yet followed by no benefit to the secretions of the skin, or of the kidneys; and I am induced to coincide with Dr. Bright in the opinion that mercury produces no beneficial result in this disease. It has also appeared to me to cause salivation in those cases with an unusual rapidity; an observation first made by Dr. Bright.

In two cases the general œdema was removed under the use of iodine (a grain and a half with three grains of hydriodate of potash dissolved in a pint of water, given in the day time). As, however, both those patients were kept in bed, and by means of external heat a restoration of perspiration had been effected, they cannot be adduced as evidence in favour of the action of iodine in the disease.

[1] M. Coster has reported cases of dropsy successfully treated by the following preparations of iodine, viz. hydriodate of potash six grains, iodine three grains, dissolved in one ounce of water, given in a dose of six drops, gradually increased to fifteen, in sugar and water; and by dressing vesications formed on the thighs with an ointment of half a dram of hydriodate of potash, iodine fifteen grains, and lard one ounce; also employing it in frictions to the soles of the feet and axillæ.

He has also made some curious experiments to prove the passage of the iodine through the different parts composing the animal structure. He injected a solution of starch into the bladder of a dog, and a solution of iodine into the rectum of the same animal. The urine in the former in a short time acquired a blue colour. He also injected the iodine solution into the rectum, leaving the bladder empty; in this case a blue colour was produced when the dog passed his urine into a vessel containing starch. (Journ. de Phar. Nov. 1834.) I am obliged to state that I have not as yet been able to detect iodine in the urine of those who have been taking it, although I have not been unmindful of Dr. Clendenning's suggestion.

The object which I had in view in using it was to ascertain how far it would act in causing absorption of the morbid structure developed in the kidney. During the time of the residence of those patients in the hospital, the coagulability of the urine diminished very much, but did not disappear altogether; its colour and transparency were, however, completely restored. Had they been content to have remained longer under the treatment, it is probable that a total absence of albumen in the urine might have been witnessed. In the majority of the other patients, dismissal from the hospital took place when the same degree of improvement had occurred in the urine, but before a total disappearance of albumen had been obtained; and as soon as the œdema was removed, the patients generally thought themselves cured, and became anxious to leave the hospital as soon as possible.

Individuals who have been thus relieved from dropsy by a restoration of the functions of the skin, are liable to relapses if exposed to cold, so as to produce a return of the cutaneous obstruction. Hence they ought to wear flannel next the skin, and to make a timely use of baths and frictions, in case of dryness of the surface recurring. For those in affluent circumstances a residence in a warm climate cannot be too strongly recommended. If the muscular forces permit, exercise should be used till the effects of it are perceived on the skin; and, as œdema of the legs may recur, in consequence of the previous distension and subsequent relaxation of the cellular texture, it is expedient to wear bandages on the legs, until the ordinary vigour of health has for some time been established.

The diseases which were complicated with this affection have already been enumerated. The peculiar treatment which those complications required I shall now endeavour briefly to describe.

When combined with bronchitis, the use of copaiba, as already mentioned, appeared of the most decided advantage. In dry bronchitis the following mixture usually caused free expectoration:— R. Gum. ammon. gum. arab. sacchar. alb. singul. dr. ij. Bals. copaib. dr. ss. aquæ cinnamomi, oz. iv. A teaspoonful to be taken every hour and a half. In some instances in which the copaiba produced nausea, it was superseded by the tincture of cubebs, a medicine which, although totally differing from it in botanical and chemical relations, yet agrees with it in medical as well as sensible qualities. When expectoration continued to be copious for a long time, without any benefit resulting therefrom, and the principal distress arose from its quantity impeding respiration, then, in conjunction with the diaphoretic course, the administration of acetate of lead, one grain, and watery extract of opium, quarter of a grain, four times daily, caused a diminution of expectoration, and, at the same time, diminution of irritation in the air passages. The application of leeches externally to the larynx, the number varying from two to eight, is a most important part of the treatment of bronchitis. The good effects of it are not confined to the larynx, but are apparent also in the unloading of the mucous membrane of the bronchial

tubes throughout their entire extent, causing a more immediate cessation of cough, and relief of dyspnœa, than any remedial measure which I have had an opportunity of employing. In addition, blisters should be applied to the upper part of the sternum, and under the axillæ. I have generally used also, in these cases, frictions to the back, and sides of the chest, with the stimulating embrocations already mentioned applied several times daily. Under the use of these and other similar applications, I have frequently had the satisfaction of believing not only that the bronchitis was at an end, but that portions of emphysematous lung were restored to a healthy state. If asked for the evidence of this latter fact, I answer, that regions of the thorax, which had an unnaturally clear sound on percussion, and yet no audible respiration, or which presented the dry crepitus, and clear sound of emphysema, were, when subjected to this treatment, found gradually to resume the respiratory murmur of health, while the peculiar dyspnœa, characterised by longer expirations than inspirations, was at the same time removed, or notably diminished.[1]

When irritations of the stomach or bowels occurred, they were met by nearly the same treatment as if the disease now before us was not present. Leeches placed over the affected organ, with warm applications externally, and a diet consisting of rice, or arrow-root, frequently removed them in a few days. A tendency to dysentery, which is one of the most frequent forms of this complication, and which commences by tenesmus and general excitement, was most speedily removed by an enema of four grains of nitrate of silver, dissolved in eight ounces of distilled water, followed in three hours afterwards by the starch enema, with tincture of opium. The first is retained only a few minutes, but the last generally remains several hours, and the irritation is then at an end. Although the efficacy of these measures, no doubt, depends much on the promptitude with which they are applied, yet they have been found not to fail even in long protracted cases of chronic dysentery, when aided by other appropriate treatment.

When combined with pericarditis, the internal use of tartar emetic, in addition to topical and general blood-letting, produced a great increase of urine, with amendment of all the symptoms; while a decrease occurred on two several occasions, in which it was for a time superseded by squills. In valvular disease of the heart, and, especially, imperfect closure of the aortic valves, the patient, in addition to the diaphoretic treatment, took a mixture of a small quantity of tincture of digitalis, with carbonate of ammonia, camphor, and Hoffman's liquor. This combination was intended to act as a sedative to the heart, and, at the same time, as a stimu-

[1] It will be recollected how traumatic emphysema of the cellular texture under the skin is often absorbed with facility; and there is no reason why emphysema of the lung, caused by rupture of the air vesicles from violent coughing, may not, in like manner be absorbed, when once the coughing has been stopped. And yet emphysema has been considered as incurable, and no treatment beyond palliatives is usually applied to it.

lant to the circulation through the capillaries. Whether it acted in this way or not, may be questioned; but it was certainly followed by warmth of the extremities, diminution of the violent action of the heart, a sense of general relief, and a capability of sleeping with comfort at night.

The measure, however, which appears to me of the highest importance in diseased aortic valves, is the establishment of a large issue over the region of the heart. On some future occasion I shall bring forward some faithfully reported cases, which prove that organic disease of the valves is capable of great amendment, if not of complete cure, by this and other counter irritants, aided by the administration of suitable internal remedies.

General œdema, with coagulable urine, and obstructed perspiration, is not unfrequently accompanied by effusion of serum into the peritoneal cavity. This, when not considerable, or of long standing, disappears along with the general swellings. When, however, ascites has formed either in consequence of chronic peritonitis, or induration of the liver, then, although the general swellings have been removed, we have still to deal with a refractory, and often intractable complaint. In addition to the means which are usually adopted, viz. courses of mercury and purgatives, I am enabled, from experience, to suggest some other measures, to the employment of which I must attribute the fact, that within the last four years I can recollect only one case in which tapping was performed in my hospital wards, while previously it was a frequent operation. These are the repeated application of leeches to the rectum,[1] so as to unload the vessels of the vena portæ. The applications of various stimulants to the abdomen, as 1st, an ointment composed of equal parts of iodine, mercurial, and cantharides ointments. 2dly, A paste formed of Spanish soap, spread upon linen, and sprinkled over with muriate of ammonia immediately before being applied; which, by the chemical decomposition that ensues, and the consequent gradual extrication of ammonia, produces heat and redness; 3dly, Sinapisms, suffered to remain till the pain becomes urgent. These have the advantage of healing with great rapidity. 4thly, Frictions of six or more drops of croton oil. These are, however, rather uncertain; in some individuals producing no effect, and in others followed by erysipelas, extending beyond the seat of the application. 5thly, A mixture composed of one part of tincture of digitalis, and two of aquæ muriat. calcis; a teaspoonful to be rubbed on the abdomen, morning and evening. This compound appears to excite the absorbents, and increases the discharge from the kidneys, but does not produce any sensible redness of the skin. The application of these counter irritants and excitants of the absorbents may be continued, when the administration of mercury and of drastic purgatives has become no longer advantageous, or indeed

[1] In the *Dublin Medical Journal* I have described a convenient mode of introducing leeches into the rectum, by securing them with silk threads attached to the grooves of an instrument prepared for the purpose.

safe. It is certain that by these latter remedies the distension of the abdomen may frequently be diminished to a certain extent; but beyond this it is extremely difficult to proceed. Whenever the peritoneum has engaged in the process of morbid secretion, and the cavity of the abdomen has remained distended a certain length of time, it obstinately perseveres in retaining a certain quantity of fluid. The urgent and continuous use of the powerful remedies now mentioned, in such cases, is then not only abortive, but sooner or later causes irritation and ulceration of the bowels; and the patient sinks in consequence. It is therefore preferable, in those refractory cases, when the swelling no longer diminishes under the employment of internal medicines, to abstain altogether from their use for a time, and to rely on the application of counter irritants and bandages, together with regulated courses of diet, and changes of air, until the patient's vital forces are recruited, so as to enable us to make fresh efforts to dislodge the fluid.

When noises resembling the ringing of bells in the ears, wakefulness, delirium, stupor, or headache, come on, then, if there is increased heat of the head, blood must be taken either from the temporal artery, or by means of leeches applied to the temples, or behind the ears. Calomel must be freely given, and followed by brisk purgatives. If those symptoms continue, it will be necessary to apply sinapisms to the nape of the neck, and to persevere in the use of mercurials. These symptoms, which are always of formidable import in dropsies, and peculiarly so, because usually neglected, and erroneously supposed to belong to the disease merely as symptoms, may, under this treatment, be very generally averted; and it would be acknowledged, from an examination of the fatal cases recorded in my table, that, though the patients died immediately from the affection of the brain or its membranes, yet in most, if not all of them, peculiar circumstances existed, which had the effect of disarming the remedies now mentioned of their usual powers, and which, in those particular instances, rendered the disease necessarily mortal.

In conclusion: the observations which I have been enabled to make on dropsy with coagulated urine have appeared to me to prove,

1st. That it is always connected with disease of the kidney, which, when sufficiently advanced, is marked by the deposition of a grayish structure, impermeable to injections, within the substance of that organ.

2d. That the suppression of perspiration is the most general cause of this disease; and the long-continued excitement of the organ by spirituous liquors, or diuretics, the next in order of frequency and importance.

3d. That the most successful treatment consists in the restoration of the functions of the skin; which being accomplished, the disease, if free from complications, never fails to be removed.

4th. That bleeding and purgatives are also suitable remedies; while diuretics are either injurious, or, if removing the swellings

for a time, tend ultimately to cause a return of the disease, under a more aggravated and intractable form.

The constancy with which either this disease or diabetes is preceded by a continuous repression of perspiration, renders it expedient that this state of the skin should be considered as a peculiar disease; for which purpose it may be called *Anidrosis*. The use of forming this designation, is, to direct the attention of practitioners to a morbid state, which escapes observation because not signalised by pain, but which is not only a disease in itself, but leads to many other and fatal diseases.

CASES ILLUSTRATIVE OF RENAL DROPSY.

Case I.—*Renal Dropsy—Pneumonia—Arachnitis—Death.*

Henry M'Mahon, aged 38. October 29, 1834. Anasarca of lower extremities; cough, and general soreness in the chest; pulse 84, soft; obscure crepitus heard throughout both lungs, especially in right, and some dulness on percussion; no perspiration, and states that it has always been difficult to make him perspire; appetite diminished; tongue rather dry in the centre; occasional diarrhœa; *urine coagulating by heat almost into a solid.*

Present symptoms came on about five weeks ago, and are attributed to wet feet. He confesses to have been addicted to drinking whiskey. On his arrival in hospital, two days ago, he commenced the use of the warm bath, and the swellings have diminished. Mittant. sang. oz. viii. R. Sulphuris dr. i. pulv. Jacobi veri gr. vi. pulv. Doveri gr. ii. syrup. sacch. emp. oz. i. confect. aromat. gr. x. ft. bolus ter in die sumendus. 30th. Blood buffed and cupped. 31st. Appears stupid; pulse 72; omitt. bolus abr. capill. vesicat. pone aures. Mist. sennæ camph. ad effectum. Nov. 1. Sleeps constantly, except when roused; pulse 60. Mitt. ex arteria temp. sang. oz. vii. vesicat. amplum occipiti. Enema terebinth. mist. cardiac. oz. i. o. h. calomel gr. iv. quartis horis. 3d. He was roused for a few minutes after the blood was taken, but died in the evening.

Necroscopia.—Kidneys enormously enlarged, and filled with granulated structure, especially at their lower part; the tubuli almost extinct, except at the upper portions; the grayish structure projecting at the outer surface of the kidneys in roundish masses; renal veins filled with clots of a grey colour; lungs engorged, and in different stages of pneumonia throughout their whole extent; effusion of copious mucus into the bronchiæ; old adhesions between the pleuræ; brain highly vascular towards the left parietal bone; veins much congested; no collections of fluid at the surface or in the ventricles.

Case II.—*Renal Dropsy—Tuberculated Lungs—Skin obstinately obstructed—Enteritis Arachnitis—Coma—Death.*

Susan Stedman, aged 20. Dec. 17, 1835. General œdema;

skin dry; extremities cold; thirst; some cough. No disease of the lungs to be detected by auscultation. Catamenia absent during the last six months; pulse 70; urine coagulating by heat. The swellings commenced in her feet about two months ago. 25th. She has been bled, has taken James's powder and calomel, with the turpentine draught occasionally. As the extremities continued cold, she got the cardiac mixture (a compound of camphor, carbonate of ammonia, and Hoffman's liquor), and had bags of hot salt kept to her extremities. The swellings are now much diminished, and the extremities maintain a better temperature, but no perspiration has taken place. R. Sol. iodinii fort. oz. iiss. tinct. capsici oz. ss. *m.* Infricetur oz. ss. lumbis ter in die. Cont. mist. card. Hot salt to be applied. 31st. Swellings continue to decline. Sum. sulphuris dr. iss. ter in die. Cont. cæt. 8th. Appears stupid. Hirud. viii. temp. elect. jalap. ad effectum. 9th. Stupidity diminished. Enema fetid. Semicupium. cal. gr. iv. h. s. mist. sennæ c. *m.* 11th. No effect from purgative medicine. Tenderness of abdomen; stupidity less; vesicat. abdomini. R. Cal. pulv. Doveri utriusque gr. iii. *m.* tertiis horis sumend. mist. rosæ cathart. oz. iss. secundis horis ad effectum. 17th. Gums have become sore, and a good operation has been obtained from the camphorated senna mixture, after the failure of several others. Appears more lively; pulse 96. 18th. The stomach very irritable, retaining only saline draughts. Stupidity returns, with heat of head. Vesicat. nuchæ, haust. eff. 19th. Pulse almost imperceptible; stupidity; stomach still irritable. A poultice on the stomach; cal. gr. iii. tertiis horis; sinapisma capiti. White wine whey. 21st. Stupidity continues; face flushed; complains of pain in the region of the heart; pulse 120. Stomach now quiet. Thirst. Dej. 2. Urine scanty. R. Tinct. digital. gutt. iii. in haust. efferv. secundis horis, cont. calomel. vesicat. abdomini. 22d. Vomiting has returned. Dejections passed involuntarily. Is sensible, but very weak. Soda water and almond emulsion for drink. Cont. calomel. 23d. Urine passed involuntarily; tongue dry, brown; bad sleep; pulse 120; black dejections. 24th. Died last night.

Necroscopia.—Subcutaneous cellular tissue universally distended with serum; effusion of serum into right pleura and pericardium; heart very small; valves all perfect. In the right lung, at the apex, a large tubercular cavity communicating with a bronchial tube. Smaller cavities adjacent to it. Both lungs, except the lower portions of the inferior lobes, filled with small round tubercles in various stages. About two quarts of serum in the peritoneum; that membrane thickened and opake. The liver easily broken down, resembling a spleen. Mesenteric glands enlarged. Kidneys large; cortical substance filled with granular structure, and not containing a trace of blood. A strong urinous odour was perceived from them. Mucous membrane of intestines of a greenish white colour. Brain, between the dura mater and arachnoid, more serum than in health, and still more in the sub-arachnoid tissue. Slight congestion in the vessels of the pia mater at the left side anteriorly. But little

effusion into the ventricles. Medullary substance rather darkish; brain in other respects sound.

CASE III.—*Renal Dropsy in an incipient stage—Removed under treatment.*

Thomas Johnston, aged 53, shoemaker, admitted Nov. 3, 1833. Œdema of face and ankles first observed about ten days ago. Urine limpid, almost devoid of mucus, frothing on the application of heat. Skin dry; pulse 60, lingering and weak. Appetite, &c. natural; but during the last three months has suffered from distension of the stomach after eating. Drink 2½ pints. Urine 3 pints daily. R. Tinct. cubebæ oz. ss. mist. amygdal. oz. viiss. *m.* oz. i. tertiis horis. Ordered to keep his bed. 4th. On examination with a lens, the papillæ of the skin are shrunk. Perstet. 8th. Swelling diminished. Some perspiration after a bath last night; pulse 84. Cont. mist. bal. tep. alternis noctibus. 16th. Œdema gone. Diarrhœa, with some tenesmus, has come on. Pulv. Doveri gr. x. h. s. cont. cæt. 18th. Enema amyli. 20th. Bowels now free from irritation. 27th. Urine now no longer froths on the application of heat. Dismissed free from complaint.

CASE IV.—*Renal Dropsy at first aggravated by diuretics—Removed under treatment—The perspiration not restored.*

Bridget Flynn, aged 65, widow. Nov. 8, 1833. Universal œdema; urine coagulating by heat; severe cough; translucent expectoration; pulse 82; bronchial sounds in the chest; decubitus easiest on the right side; is frequently obliged to sit up; no perspiration; drinks about four pints in the day, and passes five; bowels habitually confined; catamenia long since extinct; duration of complaint two months; commenced on recovery from the influenza. Mist. sennæ camph. ad effectum. Hot salt to be kept constantly applied to the abdomen. R. Pulv. Jacob. ver. gr. x. pulv. Dov. gr. iv. confect. aromat. scr. ii. *m.* ft. bolus vesperi et nocte sumendus. 11th. Sleeps better. 12th. Skin continues obstinately dry; swellings rather increased. Sol. gambog. alkalin. gutt. xx. secundis horis ad effectum; enema terebinth. pil. cal. et scill. ter. in die; omitt. cætera. 15th. Swellings increasing; no effect from the drops; haust. tereb. mist. cubebæ et amygdal. R. Vini ipecac. tinct. cubebæ utriusque oz. ss. bicarb. ammon. dr. ii. aquæ menth. oz. vii. sum. oz. i. cum succi limon. oz. ss. omni hora; omitt. cætera. 18th. Œdema declining; cough better; no perspiration; haust. terebinth; urine coagulating as before; perstet. 25th. Swellings nearly gone; was dismissed in a few days.

CASE V.—*Renal Dropsy removed by treatment.*

Michael Donoghoe, a drayman, aged 38. Admitted August 27,

1836. General anasarca; swelling and fluctuation of the abdomen and scrotum; slight cough, with saltish expectoration; some dyspnœa, and tenderness of epigastrium; urine of the usual quantity, coagulating by heat; skin dry; pulse, tongue, and appetite, natural; bowels regular: complaint of one month's duration; attributed to a severe wetting; commenced with dyspnœa, chilliness, headache, nausea, thirst, and a constant wish to pass urine, which was at first diminished and turbid; was bled eight days ago; confesses to have been addicted to spirituous liquors. Admov. cucurbit. lumbis et mitt. sang. oz. x. R. Sulphureti potass. gr. x. sulphureti antimonii gr. ii. syrup. empyreumat. oz. i. *m.* ft. haustus ter in die sumendus. 29th. No sensible effect observed from the draughts; swellings diminishing; vesicat. ii. lumbis. R. Olei tereb. oz. ss. gambogiæ gr. i. *m.* sum. statim; cont. cæt. 30th. No effect produced on the bowels; urine increased; camphorated senna mixture; cont. haustus. 31st. Swellings steadily declining; cough and dyspnœa much diminished. R. Sulphuris lot. dr. ii. aquæ fænic. dulc. oz. v. sp. amm. aromat. dr. ii. syrupi croci dr. vi. *m.* sum. oz. i. ter in die. 7th. Swellings entirely gone; skin now warm, but not perspiring; has been obliged to take the senna mixture occasionally; yesterday and to-day complains of headache; vesicat. pone aures. 8th. Headache gone; was dismissed in a few days. N. B. He was kept constantly confined to bed till within a week of his dismissal.

CASE VI.—*Renal Dropsy with accompanying enteritis, bronchitis, and arachnitis—Perspiration restored—Disease removed.*

Eliza Levy, aged 18. Admitted Oct. 21, 1834. Universal œdema; skin dry; extremities cold; urine coagulating; mucous deposit lying in form of a flake at the bottom of the vessel; appetite defective; great thirst; tongue dry towards the tip; pulse 108. Duration of present symptoms three weeks. Was partially removed, but has come on to its present extent within the last four days; cause not ascertained. R. Pulv. Jacobi ver. gr. viii. pulv. Doveri gr. iii. conf. aromat. scr. i. *m.* ft. bolus h. s. sumendus; bal. cal. vesp. For drink, barley water. 23d. Urine increased; no perspiration. R. Aq. acet. ammon. oz. iv. sulphuris loti dr. ii. vini ipecac. dr. ss. syrup. empyr. oz. ii. aq. fæn. oz. ii. *m.* sum. oz. i. secundis horis. rept. bal. omit. bolus. 27th. Extremities warmer; swellings diminishing; appetite improving; perstet. 29th. Œdema of face has recurred; camphorated senna mixture; bal. vesp.; cont. mist. 31st. Skin warmer; œdema of face stationary; no perspiration; mittant. sang. oz. x. R. Carb. ammoniæ gr. ii. pulv. Jacobi ver. gr. x. sulphuris scr. i. confect. aromat. scr. i. *m.* ft. bolus h. s. sumend. bal. h. s. infus. lini lb. iii. in die. Nov. 2d. Some perspiration last night, but confined to the head; blood buffed and cupped. 3d. Repeat bolus; bal. vaporis. 5th. Anorexia; pulse 130. Pulsating sensation in the head; some perspiration after the vapour

bath; haust. efferv. omni hora; omitt. cætera. 6th. Pulse 120; heat of skin; epistaxis this morning; hirud. vi. temp.; cont. haust. efferv. Head to be shaved, and cooled with an evaporating lotion. 8th. Thirst, diarrhœa, headache, sleep interrupted by dreams; pulse 116; vesicat. ii. pone aures. hirud. xii. regioni ventric. mist. acet. plumb. oz. i. secundis horis. Enema amyli. cum opio h. s. urgent. diarrhœa. 10th. Diarrhœa diminished: dreams continue; mitt. sang. oz. xii. cont. mist. plumbi. Hot salt to the feet. 11th. Blood buffed and cupped; pulse 128; sleep improved; perstet. 12th. Headache continues; mitt. ex art. temporali sang. oz. x. cont. mist. 13th. Rep. arteriotomia. vesicat. nuchæ. 15th. Head now relieved; severe cough has come on; vesicat. sterno; cont. mist. 16th. Hirud. vi. laryngi. 20th. Cough continues; diarrhœa gone; pulse 120; nausea; thirst rep. hirud. et mist. 22d. Headache and cough much better; perspiration occurs at night on the chest and arms; pulse 116; bronchial sounds in both lungs; urine transparent, frothing, but not coagulating; rep. hirud. laryngi. R. Bals. copaibæ dr. i. muc. gum. Arab. oz. iv. sacch. alb. q. s. *m.* ft. emulsio; adde tinct. opii vini ipecac. utriusque dr. ii. aquæ cinnamomi oz. iii. *m.* sum. coch. med. omni bihorio. Dec. 1st. Cough and diarrhœa have entirely ceased; appetite returns. 11th. Swellings gone; no perspiration within the last few days; bal. cal. vesp. R. Pulv. guaici scr. i. pulv. Jacob. gr. viii. pulv. Doveri gr. ii. syr. empyr. oz. i. *m.* ft. haust. h. s. sumend. 12th. Thinks that she perspired. 23d. R. Tinct. guaic. Ammon. dr. iii. sp. pimento dr. i. mist. camph. syr. empyr. utriusque dr. vi. *m.* ft. haustus post bal. cal. sumend. 24th. General perspiration after the bath. 29th. Dismissed free from complaint.

PART III.

DROPSIES PRODUCED BY IMPEDIMENTS TO THE CIRCULATION THROUGH THE HEART, OR THROUGH THE LUNGS.

1. *Impediment at the mitral opening.*—This may arise either from defective action of the valves or from narrowing of the orifice, and both of these are occasioned by adhesions or ossific deposits. The symptoms of both are nearly the same, but more intense in narrowing of the orifice. They are as follows:—1. Palpitation and oppression of breathing on exercise. 2. Dull sound on percussion, chiefly in the region corresponding to the auricles, *i. e.* upwards and towards the left mamma. 3. A sensation resembling

that communicated by the vibrations of a saw, or of a file, when the hand is placed on the heart; and a sound resembling the same, or rather that of a bellows, when the naked ear, or the stethoscope is applied. 4. Cough, with more or less bloody expectoration, and the other symptoms of pneumonia; and along with these, large discharges of blood not unfrequently occur in consequence of pulmonary apoplexy, which is almost exclusively produced by disease of these valves. 5. The patient lies with most ease on the right side, or forward towards his face. 6. The pulse is not necessarily affected till the passage from the auricle into the ventricle has become difficult, then it is small and weak; and in proportion to the same difficulty the extremities become cold and œdematous. The face is frequently swollen at rather an early period, and before the real seat of the disease is suspected. Intermission or irregularity of the pulse, as they do not depend on mechanical obstruction, but on debility of the organ preventing it from maintaining its accustomed rhythm, either may or may not be present, and they are not to be taken as diagnostic of this, or of any other valvular disease of the heart.

In enumerating the above symptoms as strictly belonging to obstructed or permanently opened passage, from the auricle to the ventricle, at the left side of the heart, I am guided by a review of a great number of cases, and dissections, and am anxious to impress on the mind of the reader my conviction, that they are sufficient to enable him to form a diagnosis of the disease. The sounds of the heart have been too exclusively dwelt on by most writers, since the time of Laennec, while the peculiar symptoms occasioned by the mechanical derangements of the circulation have been in the same proportion neglected. By some the sounds alone have been thought to diagnose affections of the aortic or mitral valves, according as they accompanied the long or the short vibrations of the heart; but as they may be produced as well by the fluid regurgitating backwards as by its passing forwards, it is impossible; and besides who ever hears those sounds accompanying the short vibration, unless when also heard with the long one?

Imperfect aortic valves have appeared to me long since to be the most frequent of all diseases of the heart, belonging to advanced life, and to hold in this respect the same rank as emphysema in the lungs, and softening of the brain, do as climacteric diseases, which in the great majority of those who have survived the affections arising from the various noxious influences to which we are all subject, are destined to terminate their present state of existence. Those valves which, when the ventricle relaxes after its contraction, prevent the regurgitation of the blood from the arterial trunk, are so adjusted that at this time they are distended into the shape of cups, while the small triangular space in the centre of them is closed by the corpora aurantia. A very minute deficiency in their size is followed by an escape of some fluid back into the ventricle. This deficiency may be caused first by dilatation of the heart, rendering the orifice too large to be closed by the valves; secondly, by

thickening of the valves, and consequent retraction of their margins; thirdly, by rupture of a valve; fourthly, by ossific deposits projecting within the orifice, and thus preventing their contact. The consequences are the same. Regurgitation of blood takes place after each contraction of the heart; the left ventricle is unduly distended; violent action is the consequence, and thus not only dilatation, but hypertrophy is induced, and the symptoms now to be enumerated are the necessary result of this state.

The symptoms of imperfect aortic valves are: 1. Bounding[1] of the

[1] This appearance has been to me a source of much perplexity, and the value which I attach to it, being founded on facts, which may appear to some uncertain, the attention of the reader is requested to the following particulars:—First. There is a great difference between bounding of the larger and smaller arteries with regard to the cause producing it. I this day examined the wrists of the gentlemen of the clinical class, all of whom were in the enjoyment of youthful vigour and good health. In eight out of nine of them then present, there was bounding of the radial arteries. The individual who had not the bounding, although remarkably muscular, yet has an unusually small pulse, and in him it can be produced in the temples by exercise. In all persons it is much more evident in summer than in winter; and in cold weather it often becomes imperceptible. Second. Bounding of the brachial artery cannot be produced by any exercise, however violent, in those who have it not when at rest. Third. Of a number of patients in the hospital in summer, who had bounding of the radial arteries, there were four who had also bounding of the brachial and subclavian arteries, and in all of these there was evidence of disease of the heart, viz. palpitations on exercise, dull sound around the cardiac region, or *bruit de soufflet*. Fourth. In every case which has been under my care since my attention has been attracted to the subject, (*i. e.* within the last six years.) in which there was bounding of the larger arteries, when terminating fatally, and examined after death, some imperfection of the aortic valves, necessarily producing regurgitation from the aorta into the heart, was detected. The imperfection of those valves which is most apt to escape notice is thickening, which to superficial observers appears to be the natural structure; and I have seen reports of dissections, in which this great mistake must have been committed. A good mode of ascertaining the healthy state of the aortic valves, is by comparing them with the valves of the pulmonary artery in the same individual. The latter are so rarely diseased, that they may in the great majority of cases, be appealed to as specimens of the healthy state, and almost closely resemble the aortic valves in the healthy state.

It is to me subject of regret, that I am unable to illustrate the connection between regurgitation and bounding of the larger arteries by experiment. On injecting into the aorta a warm fluid of the consistence of the blood with a large syringe, and by a powerful arm, in jerks so as to imitate the contractions of the heart, no visible pulsations could be produced in any artery, and only a faint pulsation resembling that occurring in a low fever could be felt by the finger, but could not be perceived by the eye. Thus I was disappointed in my expectation of establishing by experiment what I believe is the fact, that in order to produce bounding of the brachial and subclavian arteries, there must not only be increased action, but also regurgitation.

Arteries in bounding are turned aside from the straight line and describe a greater number of curves. This is a necessary consequence of their elongation from the additional blood rushing into them, their extremities being fixed points. In the healthy state this only takes place in the smaller arteries to which the impetus from the heart ultimately tends; but when imperfection of the aortic valves exists, then not only is the bounding of the smaller arteries greatly increased, from the increased impetus of the more capacious

larger arteries. 2. A dull sound on percussion, extending across the lower part of the sternum to the right side. 3. Exercise producing a feeling of distress, distinctly referred to the region of the heart, and not connected with respiration. 4. A sound resembling that of a bellows, often more audible in the larger arteries, and especially in the right subclavian, than in the heart; sometimes perceptible to the hand applied over the heart, when it cannot be recognised by the ear; sometimes entirely absent, but when loudest then denoting ossific projections on the valves. 5. Increased action of the heart, and preternatural strength (not quickness) of the pulse; the force of the pulse being always remarkable even when not increased under the excitement of exercise. It is also to be noted, that in some rare cases when the heart has attained an enormous size, the motions of it cannot be perceived either by the hand or the ear, a state which is perhaps to be attributed to the compression exercised on it by the pericardium and surrounding parts.

Œdema and coldness of the extremities are more early attendants on disease of the mitral than of the aortic valves. The mitral valves are effected by far more frequently in females, while men are more subject to disease of the aortic valves. The cause of diseased mitral valves in all the cases in which I was able to trace it, was inflammation from cold contracted in various ways; and to this may be attributed the frequent occurrence of disease of those valves along with pericarditis. The causes of diseased aortic valves are more numerous, and are as follows:—1. Inflammation from cold, producing a thickening and consequent retraction of them, or else ossific depositions. 2. Severe muscular exertions causing dilatation at the orifice of the aorta, or rupture of the valves, and sometimes both combined. 3. Pressure from without on the region of the heart.[1] 4. Chronic bronchitis and emphysema of the lungs, which when long continued, cause difficult transmission of the blood. In protracted cases of this kind, a careful examination will often detect considerable breaches in the membrane forming the valve, and sometimes its edges appear as strings separated from the rest. Those morbid changes have hitherto been very much overlooked, from the prevalent notion that ossification is the only disease to which the valves are liable.

Diseases of the valves of the right cavities of the heart are exceedingly rare. I have seen only one instance of diseased valves of the pulmonary artery. The consideration of them therefore may be omitted in a practical point of view.

and hypertrophied heart, but a new phenomenon, namely, bounding of the larger arteries, (entirely quiescent in the healthy state,) takes place in consequence of regurgitation into the heart. In this case the bounding takes place in both lower and upper extremities, and it thus occurring in all the arteries is a proof that it must be derived from the heart.

[1] Shoemakers rest the last on the sternum towards the left side, and tailors in this country constantly stoop forwards at their work. Both are peculiarly liable to diseased aortic valves.

With regard to the treatment—I would premise that as the valves are part of the living system, they are not to be considered as beyond the restorative powers of nature. There can be no doubt that they are furnished with absorbents, and that as they are subject to disease, so they are also capable of curative processes. Hence it appears, *à priori*, possible that counter-irritants, and remedies which have the power of exciting absorption, should cause favourable changes in the structure of those valves, and consequently in their mode of action. In order to ascertain whether this actually took place, in several instances I carefully abstained from the use of internal remedies, and for a time confined the treatment to the application of leeches and blisters on the region of the heart. The effect was in every case, except those of old date, decidedly beneficial. In many, dropsical swellings disappeared, and sleep was restored within a week, with an increased fulness and softness in the pulse, which in those individual cases could only be explained by a greater facility in the transmission of the blood through the heart having taken place in consequence of the re-establishment of a more complete action of the valves. As those measures are applicable to every case, and do not interfere with any others in the treatment of these diseases, to them the first place must be assigned. Blisters may be applied almost immediately after leeching, by covering the leech bites with small pieces of paper, or adhesive plaster. After those have been some time in use, it is most expedient to place an issue or seton over the heart, which, although inferior to the former, yet when once established, is less under the control of the patient.

Digitalis, by far excelling all narcotics in its sedative action on the heart, is only required when there is irritability of that organ, above what is required for carrying on the circulation. As the alternate filling and emptying of the heart must be incessantly kept up, or life is extinct, it is manifestly injurious to debilitate the organ performing these functions when it already labours under peculiar mechanical difficulties imposed on it by disease. Sometimes, however, the heart is rendered morbidly irritable; of which we see instances in pericarditis, in rheumatism of the heart, and in nervous excitements, producing great frequency and force of pulsations. The same occurs in connection with disease of the valves, and the existence of this state is to be inferred from over action of the heart, to be felt by application of the hand, from increased quickness and frequency of the pulse. By these, taken in connection with the peculiar circumstances of the case, the use of the digitalis is to be determined. When it has produced softness of the pulse when hard, or reduced it to the natural standard when over frequent, a continuance of it is useless, and may become dangerous. The diuretic virtues of this medicine are always most apparent when given in pursuance of this rule; and although it possesses an acrid principle, which is capable of irritating the stomach, and which very possibly acts on the kidneys when taken into the circulation, yet its diuretic effect in almost every instance appears to be in

consequence of its allaying the inordinate action of the heart, and consequently facilitating the circulation through the capillaries.[1]

As we cannot afford the heart any cessation from its labours, and as its mechanical function must be performed, even under the greatest disadvantages; when we on the one hand see it expend itself in violent and unnecessary efforts, or on the other see it sinking from want of vigour, we are obliged to act according to the exigency; in the first case to lower its tone by digitalis and other remedies, and in the latter, to administer tonics and excitants. The benefit derivable from preparations of bark, has appeared to me manifest, when the heart has to struggle with mechanical difficulties, and is unable to perform its contractions with its accustomed rhythm. In a great majority of instances, irregularity, or intermission, of the pulse is to be taken as an indication of the heart being in a state of exhaustion; or we may infer this debility already to exist, when increased labour is imposed on it from either adherence or imperfection of the valves. Under these circumstances I give combinations of digitalis and quinine, with the combined effect of tranquillising and invigorating the heart, as evinced by the improvement of the pulse, and restoration of natural heat to the extremities.

The value of blood-letting depends much on the tone of the heart, at the time when it is performed. When there is accumulation in the veins and lungs with the heart in a struggling state, in consequence of over distension, a detraction of blood from the veins causes immediate relief; but in order that this relief may be permanent, or rather, in order that it may not be followed by dangerous sinking, it is requisite that the heart should have sufficient vigour to profit by the removal of the weight. Hence on the day when bleeding is performed, it is usually expedient to prescribe a few stimulant draughts, composed of camphor mixture, with Hoffman's liquor or carbonate of ammonia. The good effect of bleeding in uncomplicated disease of the heart is, however, for the most part only temporary, and the practice of treating disease of the valves by frequent repetitions of it, cannot be too strongly reprobated.

When the urine does not coagulate, or merely throws up a slight froth on being boiled, then the dropsical swellings consequent on disease of the valves, are to be treated with diuretics, and one of the best is the old established compound; of calomel, one grain, squill, two grains, and digitalis, one grain, to be taken thrice in the day. While taking these pills the bowels are usually free twice or oftener daily, and it frequently becomes necessary to give a few grains of Dover's powder at night, to check the tendency to

[1] The great advantage which I have obtained from it in the treatment of amenorrhœa is a confirmation of the correctness of this explanation of its mode of action. In cases of menstrual obstruction with excessive action of the heart and yet cold extremities, I often, along with the hip bath, &c. use the following formula, at the time when that discharge is to be expected: R. Tinct. digit. dr. j. sp.'amm. aromat. dr. iij. infus. secal. cornut. oz. viiss. *m.* St. oz. j. tertiis horis.

diarrhœa. The continuance of the digitalis must be regulated strictly according to the action of the heart as before mentioned; and if the bowels are too sensitive to bear the squill or calomel, they may be for a time superseded by mercurial pill, and extract of taraxacum. Diuretic drinks should likewise be taken, for example, solution of supertartrate of potash, mead or cider diluted with water.

When it is desirable to procure exhilaration with the least stimulation, either spruce beer or ginger beer may be taken.

Much of the success to be hoped from treatment will depend on the adjustment of diet to the circumstances of the case. Some of the French authors have recommended almost total abstinence, the *dicæta aquea* of the ancients. If life could be maintained for some time without the action of the heart, it is evident that great advantage would result from giving complete repose to the organ; but as this is impossible, and as we find that when some of the cavities of the heart are preternaturally distended, they resemble the bladder in the same state, and require a greater degree of vigour than ordinary, to enable them to propel their contents, it follows that abstinence must not be carried on so far as to induce languor of the pulse, or coldness of the extremities.

In sudden states of depression, when the heart is over distended, and unable to propel its contents, and the patient appears at the point of death, I cannot too strongly insist on the benefit to be derived from the use of the more powerful stimulants. By a free access of fresh air to the patient's face, the rest of the body being kept warm, and the use of Geneva and water in spoonfuls frequently repeated, the heart, even in the most desperate forms of valvular disease, may be enabled to continue its labours, and thus may time be gained for the employment of more permanently effectual remedies.

CASES TO ILLUSTRATE DROPSY FROM VALVULAR DISEASE OF THE HEART.

(In the following, the details of treatment are abridged, unless where necessary to explain the symptoms.)

CASE VII.—*Contraction of mitral opening—effusion into the right pleura—general œdema—death.*

Margaret Fagan, aged thirty, married: the last child ten years ago. Admitted 16th March 1829. Œdema of face and legs; abdomen swelled and fluctuating; conjunctiva distended and watery; cough with bloody expectoration; is generally unable to lie down; lying on the left side in particular produces a sense of suffocation. No pulse can be felt at the wrists, it is perceptible at the axilla, natural in frequency, but very feeble; extremities cold and livid; lividity of lips: tenderness at left epigastrium; dull sound on percussion at lower part of right side; slight crepitation and bronchial

sounds at right scapula; crepitus at base of left lung; dry bronchial sounds in superior part of same; has been subject to palpitations the last five years; present attack has lasted five weeks. 18th. Expectoration viscid and sanguineous; diarrhœa; fæces mixed with bloody mucus; left cheek more suffused than right; lies now on her back toward the right side. 20th. Continues sensible, and replies to questions; pulse imperceptible at the axilla, and scarcely to be felt in the subclavian; since her admission, the action of the heart cannot be felt; lips rather less livid; other symptoms as before. 21st. Died this morning.

Necroscopia.—Thorax: right cavity nearly filled with transparent straw-coloured serum; lung compressed towards the root, and upwards under the clavicle; lower lobe nearly severed from the rest, and adherent to the diaphragm; several bands of lymph, intersecting each other, held the lung in this position; substance of the lung nearly hepatised in two or three parts; the remainder in less advanced stages of inflammation; left cavity, lung emphysematous at inferior angles and anteriorly, some inflammation commencing in the upper part of the lower lobe; bronchial tubes highly vascular; pericardium containing scarcely half an ounce of fluid. Heart: auricular portion much enlarged; left auricular ventricular opening closed, so as barely to afford passage for a goose-quill; left auricle hypertrophied, and in it an ovate mass formed of concentric layers of fibrine (as in aneurisms) about the size of a walnut, and attached by a pedicle; the interior of this was opened, and found to contain a grayish white fluid. Abdomen: some fluid in the cavity of the peritonæum. In the uterus, three small vascular tumours.

CASE VIII.—*Contraction of mitral opening—ascites—œdema—pulmonary apoplexy—pneumonia—death.*

Sophia M'Keon, aged 23, married; last child a year ago; admitted 9th of April, 1831; cough; dyspnœa—the latter greatly increased by lying on her back; severe pain in the left side; expectoration bloody; respiration almost inaudible, with dull percussion at the base of the left lung posteriorly; bronchial sounds in various portions of both lungs; abdomen swelled and fluctuating; œdema of legs; pulse 84; extremities cold; reports her cough to have lasted four years; has suffered from dyspnœa during the last four months, for which she was under medical treatment in Manchester: she was now directed to be bled, and to get pills of calomel and squill, and a mixture of decoction of seneka with Hoffman's liquor. 10th. Expectoration bloody; *bruit de soufflet* in the long sound of the heart: when the operation of bleeding was performed, the blood was at first projected from the vein, as if from an artery; a blister, and to continue the remedies. On the 16th she was bled, and on the following day the cough and dyspnœa were much improved; the expectoration was less sanguineous; crepitation heard in inferior part of right lung poste-

riorly; ptyalism; infusion of juniper, with tartrate of potash. 19th. Pulse 108, scarcely perceptible; yesterday had a slight pain in the left breast, which is now enormously swelled and fluctuating, with appearance of ecchymosis; œdema of face increased; respiration easy; debility much increased; awoke with screams several times during the night; draughts of camphor mixture, Hoffman's liquor, and carbonate of ammonia, every second hour; six ounces of wine. 20th. Died this morning.

Necroscopia.—Thorax: aortic valves thickened, and presenting semicircular edges; mitral valves ossified, and adherent to each other; leaving an opening between the auricle and ventricle, less than the size of a sixpence, which could not be closed; left auricle greatly hypertrophied and dilated; both ventricles, as well as the left auricle, dilated; above a pint of brown serum in the pericardium; a small quantity of fluid in both pleural cavities; two large coagula of blood in the substance of the right lung towards its base, some smaller ones in the left.

CASE IX.—*Symptoms as in the two previous cases, with œdema and coagulable urine—relieved.*

William Behan, aged 20, shop porter. June 8th, 1836. Cough, especially at night, with frothy and salt expectoration; dyspnœa, soreness at the pit of the stomach, with a sense of tightness and weight; decubitus easiest in the prone posture. He cannot lie on his back, and generally sits up; dull sound on percussion beyond the præcordial limits; a loud *bruit de soufflet*, respiration over chest very feeble with a trace of crepitus, most distinct in the left side posteriorly; has had hæmoptysis; distress greatly aggravated by exercise; sleep disturbed by starts; urine frothing thickly when heated; appetite moderate; pulse 96. About eighteen months ago, his complaint commenced; he obtained relief in hospital, but a renewal of the symptoms came on about three weeks ago; he has been much exposed to cold, and is addicted to drink. Mittant. sang. oz. xij. elect. jalap. ad effect. haust. eff. c. mist. camph. 10th. Hirud. viij. reg. cord.; cal. gr. iv. o. n.; rept. elect. 11th. Œdema declining; dyspnœa less; pulse 96; balsam copaib. gr. xxx. o. n. vesicat. reg. cordis. 16th. Swellings nearly gone; sleeps well; about two dejections daily; R. ext. tarax. gr. iv.; digital. gr. i.; carb. ammon. gr. i. *m*; ft. pil. ter in die sumend. 24th. Dismissed free from complaint.

Dropsy from Disease of the Lungs.—Those diseases which most interfere with the passage of the blood through the lungs, are pneumonia in its advanced stages, and emphysema. In pneumonia, the disease has hitherto been so generally treated by bleeding at the commencement, that the opportunities of seeing its advanced stages have been comparatively rare; but since what has been termed the tartar emetic treatment has been introduced into this country, and the practice of bleeding has consequently been

to some degree discouraged, it appears to me that the advanced stages and fatal terminations of pneumonia have been more frequent; and in this judgment I am confirmed by records on the large scale. Œdema following pneumonia is usually gradual in its approaches, being at first confined to the ankles. When unaccompanied by coagulable urine, pills of calomel and squills, repeated till the mouth is slightly affected, and occasionally superseded by draughts of a dram of acetate of potass dissolved in an ounce of infusion of juniper, with the addition of compound spirit of juniper one dram, and sweet spirit of nitre ten drops, to be taken thrice in the day; for hepatisation of the lungs, friction over the hepatised portion, with equal parts of mercurial, iodine, and cantharides ointments; and for emphysema, in addition to the treatment above recommended, frictions with equal parts of tincture of capsicum and compound camphor liniment to the emphysematous regions, are suitable adjuvants; and in both those diseases, much depends on keeping the skin in a perspiring state by confinement to the bed, and by the administration of diaphoretics at night. It often happens, under this treatment, that the œdema is removed, although the disease of the lungs may prove refractory, and even proceed towards a fatal termination; and such cases afford a good illustration of the impropriety of directing exclusive attention to dropsy, which is only a symptom, to the neglect of the disease which produces it. Emphysematous portions of the lungs often become œdematous when the general dropsy cannot be successfully combated; and this may be known, not only by a dull sound on percussion succeeding the clear sound of emphysema, but also by a diminution of that peculiar respiration of emphysema which consists in the expirations being much longer than the inspirations; a peculiarity which I am surprised at not having seen described, as its importance merits, in works written professedly on the subject.

Case X.—*General œdema—pneumonia—recovery.*

Catharine Walsh, aged 60, married. 8th March. Swellings of face and exterior of body; pulse 70; cough, with copious semi-viscid and semi-transparent expectoration. Bronchitic sounds throughout both lungs; moist crepitus towards the base of the left; sleeps much more than usual, and complains of a noise in her head resembling the tide, accompanied with stupor. Duration of illness twelve weeks. Has been taking pills of calomel and digitalis, with electuary of jalap, during the last five days. Mitt. ex arteriâ temp. sang. oz. xij. R. Cal. digit. utriusque granum scillæ grana ij. *m.* ft. pil. tertiis horis sumenda. 9th. Noise in the head diminished; crepitus in left mammary region; cont. pil. 15th. Severe cough; pulse 96, strong, full; swellings gone. Mitt. sang. oz. xiv. cont. pil. 16th. Sanguineous expectoration this morning; blood not buffed. After this day, the improvement was steady and rapid, and she was dismissed free from complaint.

Case XI.—*General œdema—bronchitis—emphysema. The two former removed, and the last evidently reduced under treatment.*

John Kergan, aged 12. February 28th. Severe cough; urgent dyspnœa; expirations twice as long as inspirations; palpitations excited by any exercise, however slight; pulse 128, weak; lips livid; face and extremities slightly œdematous; bronchitic sounds throughout the chest; emphysematous crepitus at the lower half of the left lung, with unnaturally clear sound on percussion; decubitus easiest on the left side, or leaning forwards. Duration of present symptoms nearly three months. Hirud. vj. laryngi; vesicat. sterno; pil. ipecac. et sod. ter in die. March 4th. Cough much better; pulse 80; ordered an expectorant mixture, and the following liniment to be rubbed over the emphysematous portions of the lung three times daily. R. Liniment sapon. oz. ij., mist. camph. oz. i., olei terebinth. tinct. iodinii utriusque, oz. ss. *m.* 9th. Cough much less; lividity of lips and œdema gone; ordered a mixture of gum ammoniac; liniment to be continued. 13th. Emphysematous crepitus now heard only at the lower edge of the lungs, and the respiratory murmur is restored nearly throughout the lung; length of expirations to inspirations as three to two. Dismissed in a few days free from complaint.

This case is remarkable, from the removal of all the symptoms of emphysema under the use of the above mentioned liniment, which was rubbed in with exemplary diligence by a patient who happened to be in the same ward during his illness.

Debility is the cause of those dropsies which supervene in far advanced stages of several chronic diseases; as phthisis, chronic dysentery, cancer, &c.; and they appear in such cases to be produced by imperfect transmission of the blood through the heart and lungs. Dropsy of this kind, considered independently of the disease producing it, may be treated by the chalybeates much diluted, as in some of the mineral waters, or by alternate changes of various diuretics to be described under the head of ascites. The slight form of this kind of dropsy, which consists in swelling of the ankles coming on every evening, often yields to twenty drops of sweet spirit of nitre taken thrice daily, with occasional purgatives, as the following:—R. Supertart. potass. dr. i., cambog. gr. i., camphor. gr. i., in tinct. zinzib. gutt. viij., solut. mannæ oz. ss., aquæ oz. i. *m.* ft. haustus. Where there is loss of appetite, it may frequently be revived by tar water, an ale-glass full taken thrice daily; which also produces a great increase of urine, with increased heat in the extremities, but loses its efficacy generally at the end of a fortnight. It may, however, be repeatedly resumed at intervals with similar advantage.

PART IV.

ON DROPSIES DEPENDING ON TOPICAL AFFECTIONS.

1. *Ascites.*—When arising from diseased liver, it is usually sufficiently known from the history of the case, which shows the general tumefaction of the abdomen to have been preceded by pain, enlargement, induration, in the region of the liver, jaundice, ague, or some other affection, pointing out it as the original seat of disease. When the disease is most confined to the peritoneal surface, then a successful termination may be expected; but when the substance of the organ is indurated or tuberculated, then the cure is not only difficult, but in many cases impossible. The two first of the following cases are illustrative of ascites produced by inflammation of the peritoneal surface of the liver.

Case XII.

Mary Reilly, aged 32. Admitted to hospital Jan. 15. Abdomen tumid and fluctuating; œdema of face and legs; pain in the right hypochondrium shooting to the spine, increased by pressure; skin yellow; headache; alvus tarda; no sleep; appetite remains; tongue clean; pulse 76, weak; cough, with nausea and diarrhœa, commenced five weeks ago. Complaint attributed to cold. Has been taking pills of blue pill, squill, and calomel. R. Pil. hyd. gr. iij., ipecac. gr. i. ter in die; admoveantur hirud. xij. regioni jecinoris; cream of tartar whey. 16th. Pain on pressure gone; yellowness diminished; pulse 72. R. Unguent. iodinii, ung. hyd. muriat. ammon. sing. dr. ij. *m.* divide in chartulas viij. Infricetur una regioni jecinoris mane nocteque. 18th. Abdomen much less; general œdema nearly gone; pills and ointment to be continued; haust. terebinth. 21st. Has got a slight cold. Omitt. remedia; haust. efferv. 23d. Bowels lax; pulse 72; swellings gone. Dismissed free from complaint.

In the following, the same combination of ascites and hepatitis existed, and was removed under the treatment; but the head continued to labour under pain, which was not removed till after repeated applications of leeches to the Schneiderian membrane. This operation is best performed by passing silk through the tail end of the leech by a needle; and the operator can afterwards hold the thread, so as to restrain the leech from ascending too high.

Case XIII.

Ellen May, aged 25. Admitted October 19. Abdomen tumid, with fluctuation; œdema of feet; pain in right hypochondrium, increased by lying on the opposite side; pain in head and neck, the former increased by coughing; bowels confined; catamenia regular. Haust. terebinth. statim; hirud. viij. temporib. haust.

efferv. 20th. Head better; œdema less. R. Infus. juniperi. oz. viiss., sp. jun. comp. oz. ss., tart. potass. oz. i. *m.* sum. unciam tertiis horis; semicupium vesp. 24th. Œdema of legs gone; swelling of abdomen diminished; has taken electuary of jalap twice since last report, and with effect; pain of head, with dimness of vision. Hirud. ij. naribus. R. Tinct. seminum colchici. spirit junip. comp. utriusque oz. ss., infus. junip. oz. vj., tart. potass. dr. j., aquæ cinamom oz. j. *m.* sum. oz. j. tertiis horis. 25th. Head better; cont. mist. 27th. Camphorated senna mixture. 28th. Complains of frontal headache, with irritation of the conjunctiva, as from sand; pain in right shoulder; a slight tension of the abdomen. Hirud. ij. naribus. R. Assafœtidæ. extr. aloes aquos. mass. pil. hyd. carb. ammon. singul. granum. ft. pilula; secundis horis sumenda. 29th. Head well; eyes better; deject. 2. cont. pil. semicup. vesp. 31st. Bowels confined; tongue loaded; pain in the head on moving. Mist. sennæ. camph. secundis horis ad effectum. 1st. Nov. Rept. hirud. ij. naribus. semicup. emplast. ammon. cum hydrarg. lateri dextro. 2d. Head nearly free from pain. R. Sp. am. fœtid.; sp. ammon. aromat. utriusque oz. ss. *m.* sum. guttas. xxx. ter in die. 5th. Dismissed free from complaint.

The following six cases were connected with disease of the substance of the liver.

William Cuissett. Admitted Nov. 1828. Addicted to spirituous liquors; abdomen tumid and fluctuating, with occasional pain in the right hypochondrium. Before admission, had been tapped, and had been under treatment. After admission, he had two severe attacks of erysipelas, in the last of which he became comatose for two days. During the last fortnight, delirium occasionally came on. The day before his death he was free from pain, and considered himself to be recovering; but on that night he was seized with a sudden and profuse vomiting of blood, and died early next morning.

Necroscopia.—Several quarts of serum in the peritoneal cavity; liver filled with spherical tubercles; a transparent globule (*quære* hydatid) of the same size and shape being among them; mucous membrane of stomach universally vascular; large quantities of blood and bloody mucus, resembling red currant jelly, in the stomach, and throughout the intestinal tube, extending to the rectum, towards which the colour became darker; mucous surface of intestines healthy; peritoneal slightly opaque; no trace of inflammation at the place where tapping was performed. Head: increased quantity of water under the arachnoid, and in the ventricles.

CASE XIV.—*Ascites with tuberculated liver—Effect of solution of corrosive muriate of mercury rubbed on the abdomen—Death apparently caused by opium.*

Sarah M'Donough, aged 46, married, without children. Admitted May 9, 1835. Abdomen swelled, with fluctuation; urine froths by

heat; sometimes perspires; pulse 72, pungent; bowels free; dejections whitish. Complaint commenced with pain at scrobiculus cordis, and has lasted between three and four years. Was tapped three months ago. Hirud. x. reg. hepat. R. Muriat. hydrarg. corrosiv. grana iv. alcoholis oz. j. *m.* Infricetur oz. ss. abdomini ter in die. 17th. A slight erythema has been excited over the abdomen; a purging, with tenesmus, during the last four days. Omitt. frictio. R. Mist. cretæ oz. vj. ext. opii gr. ij. *m.* sum. oz. j. post dejectionem q. q.; decoction of log wood for drink. 19th. Diarrhœa has ceased. Repet. frictio. et mist. 20th. Diarrhœa returns. Cont. 25th. Vomiting and purging; tongue dry and white; pulse 120; abdomen rather softer; soreness of gums, with slight ptyalism. Haust. efferv. cum aceti opii gutt. ij. omni hora ad levamen. Enema amyli cum tinct. opii gutt. xxx. statim. Hot salt to be applied to the abdomen. 26th. Diarrhœa continued last night; pulse 104; begs that she may be tapped. R. Ext. opii aquos grana ij. sp. æther. nitros. dr. ij. aquæ lauro-cerasi dr. vj. mist. amygdal. oz. vij. *m.* sum. oz. j. omni hora et semissa; admov. hirud. iij. recto; sinapismi abdomini. 27th. Diarrhœa has ceased, without taking the mixture; leeches bled well; urine increased; sinapism. abdom. cont. mixt. 28th. Alvus tarda; pulse 84. R. Crys. tart. dr. ij. rhei gr. xiv. mist. camph. oz. iss. *m.* ft. haust. stat. sumend. A pint of spruce beer. 29th. Dej. 3. hirud. xij. abdomini; sinapisma imo abdomini. R. Calomel gr. j. ext. tarax. gr. vj. *m.* ft. pil. ij. ter in die sumendæ. 30th. Abdomen softer. Rep. hirud. cont. cæt. June 1st. Pulse 108; abdomen appears to diminish; uneasiness in the bowels. R. Sp. fœnicul. dulc. gutt. xij., sp. æth. nit. dr. j., mist. cretæ. oz. vss., syr. aurant. dr. iij., m. sum. oz. j., post pil. 4th. Complained of strangury, for which the usual remedies were ordered. The next day relief was obtained. The swelling of the abdomen continued progressively to decrease, when, after a few days, death suddenly took place in the night, and it was discovered that she had taken an unknown quantity of laudanum, a bottle of it nearly emptied having been found under her pillow.

Necroscopia.—Fluid in the peritoneum; liver tuberculated; kidneys slightly interspersed with granular structure; one ovary distended with fluid to the size of a large cocoa nut; the sac strong and thick.

Before I relate some cases of ascites successfully treated, I beg to claim the reader's attention to what has been stated with respect to this form of disease in combination with coagulable urine (See page 64). The same observations apply to ascites with coagulable urine. As the collection of fluid in the peritoneum is not a fatal occurrence, the patient should be allowed to live with it, if it appears, after a fair trial of remedies, that we are unable to remove it. Hence I am constrained to protest against the practice so commonly followed, of attacking every case of ascites with reiterated courses of mercury, and other remedies equally heroic, until either absorption of the fluid or death shall ensue. By stopping active

remedies for a time, by not continuing the use of any one diuretic as soon as it has ceased to produce an increased secretion, or has been ascertained to be inefficient, and, above all, by making frequent changes of them, I find the ascites gradually to disappear; while at the same time the general health is completely restored, and this even when the case is undoubtedly connected with deep-seated disease of the liver. It is remarkable, that, in Cœlius Aurelianus, this mode of proceeding is to be found applied to the treatment of several chronic diseases; his object being to change the mode of action on which disease depends, as we learn from the courses or cycles of remedies, which he describes under the name *recorporative* (Chron. lib. I. c. i.), or alterative and *resumptive*, or tonic. For examples: in cephalæa he commences with a *resumptive cycle.* On the first day, the patient is either to abstain entirely from food, or to use the smallest quantity. On the second, he is to take exercise, to be anointed, and to take a little either of vegetables, fish, or small birds. This to continue two days. Then he adds to the amount of food; after three days, he permits hares and kid. By degrees increasing the allowance of wine, he comes to the termination of this cycle; afterwards the recorporative succeeds. On the first day, abstinence; on the second, the bath, carriage exercise, inunction; one third of the patient's ordinary allowance of bread, acidulous wine, mustard, olives, capers, salted gruel. From the third day he adds to the quantity of food and drink; and afterwards proceeds from fish to birds, and from them to the flesh of wild animals, joining to these external applications of various kinds. At the termination of this cycle, he gave emetics of mustard, or of vinegar of squill, and aided the vomiting by warm water. In like manner the patient resumed the same course anew. What was done by Cœlius in the article of diet, I have endeavoured to accomplish also in respect to medicines. In the diseases of the liver, connected with ascites, having frequently observed amendment to follow the occurrence of copious spontaneous hemorrhage from the bowels, I determined, in some cases, to carry into effect the mode of producing this hemorrhage, which I described in the third volume of the Dublin Journal. Two or three leeches are transfixed with a needle, and attached by strong silk. The silk threads having been placed in the grooves of the instrument, the leeches are introduced along with it into the rectum above the sphincters. They usually remain about a quarter of an hour, and at the end of that time may be pulled out by the extremities of the silk, which remain outside. The hemorrhage subsequent to their application, has not in any instance lasted so long as to render it necessary to adopt any measures to stop it; but in case of such an occurrence, an enema of solution of nitrate of silver would probably be sufficient.

External applications are of the greatest importance in this disease. Mr. Hunter said that an inflamed surface was a bad absorbing one. The contrary appears to be the fact; when mercurial ointment is applied to the skin in erysipelas, it produces ptyalism

with singular rapidity; and wherever blisters have been applied, there the ecchymosis of leech-bites disappears much sooner than in other parts of the skin, thus showing increased activity of the absorbents. Hence, in order to promote the general effect of mercurial or iodine ointments on the surface of the abdomen, it is well to add some cantharides or camphor, or to apply a sinapism to the skin previously to their use. As soon as mercury has produced soreness of the mouth, it should be suspended, as a severe salivation is usually found to interrupt the secretion from the kidneys; but its moderate action may be kept up by small doses of blue pill, frequently repeated for some time, during which counter-irritants over the abdomen are to be assiduously applied, except when replaced by fomentations, which have been known in the hands of ignorant persons to have sometimes accomplished a cure,[1] even when unassisted by other means.

In the treatment of ascites more than any other form of dropsy, the repeated use of purgatives is required. These should be varied according as they act on different portions of the intestinal tube. I here subjoin some of the most suitable formulæ, with the number of dejections which they produce, as averaged from a great number of observations:—

	Average number of motions.	Hours before com. of operation.	Observations.
Pil. Croton. comp. R. Ext. Al. aquos. dr. i., Rhei. scr. ii., Olei Croton. gutt. vj. *m.*, Ft. pil. xxiv.—Dose 2.	4	3	Full motions in all; nausea in $\frac{1}{3}$.
Pil. Elaterii comp. R. Elaterii grana iv., Scammonii scr. i., Ext. Al. aquos. scr. ij., Ext. Hyos. scr. iss. *m.*, Ft. pil. xxiv.—Dose 2.	3	2	Nausea or vomiting in all.
Solutio Cambog. Alkal. R. Cambogiæ dr. ss. solve in aq. potass. caust. oz. ss. Dose, thirty drops in a wine glassful of water.	3	1	Full motions requiring repetition in $\frac{1}{2}$; total failure in $\frac{1}{6}$; nausea and tormina in $\frac{1}{3}$.
Haustus Cambogiæ. R. Supertart. potass. dr. ij., Cambog. gr. i., Mannæ oz. ss., Camphoræ gr. i. in Tinct. Zinzib. dr. i. solut. Aquæ oz. i. *m.*	2	3	Nausea or tormina in almost all; failure in $\frac{1}{4}$.
Mistura Sennæ campii. R. Infus. Sennæ comp. oz. vij., Sulp. magnes. oz. j., Tinct. jalap. dr. vj., Tere cum camphoræ, gr. viij. *m.* Dose, oz. i.	5	$2\frac{1}{2}$	Nausea in $\frac{1}{4}$; repeated doses required in $\frac{1}{3}$; total failure in $\frac{1}{7}$.
Haustus Oleosus. R. Olei. Ricini. oz. ss., Tinct. Sennæ comp. dr. ij., Aq. menth. pip. dr. vj. *m.*	3	$1\frac{1}{2}$	Nausea in $\frac{2}{3}$; failure in $\frac{1}{10}$.
Haustus Terebinth. R. Additur priori Olei. Terib. dr. iij. et omitt. Tinct. Sennæ.	4	2	Nausea or vomiting in $\frac{1}{3}$; motions full, rarely griping; failure in $\frac{1}{14}$.
Pulv. Jalapæ comp. Dose, dr. i.	2	3	Tormina in $\frac{1}{2}$; repeated doses required in $\frac{1}{3}$.

[1] I have in my possession a MS. account of the cases of two gentlemen, well known in the King's County, where they resided; one far advanced in

Case XV.

Robert Vaughan, aged 19. Admitted November 9th, 1835. Abdomen greatly swelled and fluctuating; œdema of legs; emaciation; pulse 96. Loss of voice; cough; skin dry; duration of complaint nine weeks. Has indulged largely in the use of ardent spirits. Pulv. jalap. comp. dr. i. statim. 5th. Bal. tep. vesp. R. Pulv. Jacob. ver. gr. viij. calomel gr. iv *m.* h. s. sumendus. Haust. terebinth. c. m. 6th. Œdema of legs diminished. Epistaxis yesterday. R. Ung. hydrarg. dr. ij., ung. canthar. dr. i., ung. iodinii; dr. iij. mur. ammon. oz. ss. *m.* Divide in chartulas viij. Infricetur una regioni jecinoris mane nocteque. Rep. pulv. h. s. semicupium. vesp. 10th. Abdomen decreasing in size; enlarged and indurated liver can now be distinctly felt. Rep. pulv. haust. tereb. c. m. cont. unguent. 11th. Epistaxis has again occurred; urine and drink reported to be equal, being three pints each. Pulv. jal. comp. dr. i. c. m. hirud. xij. jecin. cont. ung. 17th. Hirud. iij. recto. 18th. Bleeding from the rectum continued about four hours; pulv. jal. c. dr. i. cont. unguent. 19th. Rep. hirud. recto. 24th. Gamboge draught; cont. ung. 29th. Abdomen diminishing. Rep. hirud. recto; cont. ung. Dec. 3d. Rep. haust. cambog. 6th. Rep. hirud. recto; infric. ol. croton. gutt. x. c. m. 7th. Croton oil produced a bright erythema on the skin, about six hours after its first application. 15th. Abdomen steadily diminishing; hirud. iij. recto; calomel gr. iij. h. s. haust. cambogiæ c. m. 17th. Rep. hirud. R. Calomel gr. i. ext. tarax. gr. iv. *m.* ft. pil. ter die sumend. 22d. Cont. pil. rep. hirud. 26th. Abdomen continues to diminish; pulv. jal. comp. dr. i. cont. pil. 30th. Haust. terebinth. 31st. Pulv. jal. comp. Jan. 2. Ptyalism; rep. hirud. In a few days, the abdomen being reduced to the natural standard, and the size of the liver much diminished, he was dismissed free from complaint.

Case XVI.

Mary Hyland, aged 69, a widow. Admitted 9th of September, 1830. Abdomen swelled and fluctuating. A hard tumour is distinctly felt in the hepatic region; pain of right shoulder; pulse 84. Œdema of left leg occasionally; urine scanty, not coagulating by heat; some perspiration; duration of swelling of abdomen one month. Had pain in the right side three months ago, for which she took various remedies with the effect of relieving the pain.

life, who, after the treatment of the faculty had proved ineffectual, were both cured, under the care of an old woman, by the following application:—a quart of snails pounded, two handfuls of bog liverwort, the latter boiled and thickened with barley meal, and then mixed up with the former; to be applied over the navel every night, and secured with a tight bandage. After this poultice was taken off, a tight bandage was constantly worn for some time.

Elect. jalap. ad effect. 10th. Hirud. iv. recto; solution of supertart. of potass for drink; R. infus. junip. oz. vj., aceti. scill. dr. ij., tart. potass oz. ss., aquæ cinnam. oz. iss., syr. simp. oz. ss. *m.*; sum. oz. i. tertiis horis. semicup. vesp. 12th. Abdomen softer; cal. gr. iij. omni nocte; cont. cætera. 14th. R. Elaterii granum. conserv. ros. q. v. *m.* ft. pil. iv. sum. unam quartis horis ad effectum. 15th. Eight dejections after two pills. R. Scill. gr. iij. cal. gr. i. ft. pil. ter in die sumend. 16th. Haust. tereb. cont. pill. 18th. Vesicat. ij. parva abdomini; rep. haust. tereb. cont. pill. 20th. Abdomen less; rep. haust. tereb. cont. pill. 23d. R. Infus. juniper. oz. vj., tart. potass. dr. i., sp. nitri dulcis dr. ij. st. oz. i. omni mane; cont. pill. 27th. Urine increased; abdomen diminished. Haust. tereb. cont. cætera. Oct. 5th. Ptyalism; abdomen much reduced, nearly natural. Some tumefaction of liver still perceptible. Omitt. pil. cont. mist. infric. liniment. volat. abdomini quotidie. After a few days of steadily progressive improvement she was dismissed.

Case XVII.

Margaret Reilly, aged 32. Admitted to Mercers' Hospital 15th of January, 1835. Abdomen swollen and fluctuating. Pain in the right hypochondrium increased on pressure, and shooting to the spine; œdema of face; jaundice; urine unaffected by heat; pain of head; bowels confined; appetite good; tongue natural; pulse 76, weak. The abdomen began to swell about five weeks ago, at which time she was attacked with nausea and diarrhœa; she attributes it to cold; has been taking blue pill, squill, and calomel. R. Mass. pil. hyd. gr. iij. ipecac. gr. i. ft. pil. ter in die sumend.; admov. hirud. xij. regioni jecinoris; cream of tartar whey for drink. 16th. Tenderness on pressure removed; pulse 72. Yellowness diminished; R. unguent; iodinii. ung. hydrarg. muriat. ammon. singul. dr. ij. *m.*; divide in chart. viij. Infric. una mane nocteque; cont. pil. 18th. General œdema nearly gone; abdomen much less. 19th. Haust. tereb. cont. cætera. 21st. Has got a cold, with the usual febrile symptoms. R. Carb. ammon. dr. i., succi, limon. q. s. ad. saturand. adde aq. menth. pip. oz. iij., syr. aurant. oz. i., sp. ammon. aromat. dr. ij. *m.*; sum. coch. iij. ampl. secundis horis; omitt. cætera. 23d. Febrile symptoms have ceased; swellings completely removed. Dismissed free from complaint.

Case XVIII.

William Parnel, aged forty, proprietor of an eating house; of most intemperate habits. Admitted to Mercers' Hospital, 14th of May, 1836. Abdomen tumid, fluctuating; œdema of legs; jaundice; feels a sensation of a weight falling from the right hypochondrium, which prevents him from lying on the left side. Urine loaded as in jaundice; dejections clay-coloured; fulness in right hypochondrium, and dull percussion extending nearly half way up the right side of thorax; pulse 116. Anorexia; thirst; tongue

dry in the middle; great debility. Illness is reported to have commenced about three months ago, with hemorrhage from the nose, on which occasion he is stated to have lost about five quarts of blood. Cucurbit. regioni. jecinoris et mittant. sang. oz. x. mist. sennæ camph. ad effect. limonade. 16th. Rep. cucurbit. et mitt. sang. oz. xij. Sum. meridie et vesperi pulv. ex calomel. grana ij. pulv. Jacobi veri gr. vj. *m.* 17th. Hirud. x. regioni jecin. cont. pulv. haust. efferv. secundis horis. 19th. Blood passed with the last three dejections, not mixed, and unaccompanied by pain; pulse 96, pungent. Tumefaction of abdomen diminishing. 20th. Hemorrhage from the bowels continues. R. ung. hydrarg. dr. j. muriat. ammon. gr. viij. camphoræ gr. ij. *m.* Infricetur abdomini mane nocteque; cont. pulv. et haust. efferv. 23d. Some blood with each dejection; jaundice diminishing; omitt. pulv. cont. cætera. 26th. Urine of a deep madeira colour without sediment, not coagulating, (as at first,) but frothing to heat; three dejections daily, of a better colour; pulse 96. Abdomen to be sponged with the nitro-muriatic solution twice in the day; cont. unguent.; a pill of elaterium; a bottle of spruce beer daily; omitt. cætera. 30th. A great operation from the pill; mouth sore; ptyalism. Had a perspiration the night before the last. Mist. quininæ oz. ss. ter in die pulv. Doveri gr. viij. h. s. (These were ordered to hold in check the ptyalism which appeared likely to become excessive). Decoct. catechu pro gargarismate. June 2d. No swelling now except in the abdomen, which is much diminished. R. Liniment. camph. comp. tinct. capsici utriusque oz. ij. liquor muriat. calcis, tinct. digital. utriusque oz. ss. *m.* Infricetur abdomini oz. ss. ter in die. R. Infusi pyrolæ umbellatæ oz. viij. infus. tarax. oz. iij. acetat. potass. oz. j. *m.* sum. oz. jss. ter in die. 8th. Swelling of abdomen steadily diminishing; mouth very sore. Haust. terebinth. garg. boracis; cont. cætera. 13th. Improving in every respect; abdomen nearly natural: pulse 90; urine increased; mouth still sore. Elect. sulphur. coch. min. mane et meridie. The medicines of the 2d June were resumed for a few days, and he was dismissed on the 23d free from complaint.

Case XIX.

Thomas Connor, aged forty-two, afforded a remarkable proof of the advantage of hemorrhage from the portal system. He was admitted into hospital the 26th of April, with ascites and general œdema. The enlarged liver could be felt extending over the greater part of the abdomen. The urine coagulated by heat. The treatment consisted chiefly in the application of leeches and cupping over the region of the liver; thirty drops of balsam of copaiba thrice daily; rubefacient frictions, with frequently repeated elaterium pills. Although the swelling of the abdomen declined, and the coagulation of the urine was less, still the progress towards recovery was very slow till the 2d of June, when a vomiting of blood to a large amount took place. After this the diminution of the liver

and of the fluid in the abdomen went on rapidly without any change of treatment, and he was soon discharged free from complaint.

A singular case occurred to me, which showed that the pain at the tip of the right shoulder, which is so common an attendant on affections of the liver, belongs to irritations at its posterior and diaphragmatic portions rather than to those of its anterior. A young woman had repeated abscesses of the liver. When they proceeded inwards (as known by their bursting into the stomach), then for some time previously there was the pain at the shoulder; but this did not come on when they protruded outwards. She experienced the same combination of symptoms at several repetitions of her disease.

Ascites produced by peritonitis, independently of disease of the liver, is usually easy of cure if not of long duration. In the following case it was combined with pleuritic effusions; and it will be perceived that these also yielded to the ordinary treatment.

Case XX.

Patrick Connolly, aged fifty, a porter (deprived of one of his legs), admitted 27th of October, 1831. Abdomen swollen and fluctuating; pain in left hypochondrium preventing him from lying, except on his right side or back; some cough and dyspnœa on lying down, especially on the left side; left foot œdematous; urine much diminished, uncoagulable; pulse 80; during the last five weeks he is stated to have passed only about two wine-glassfuls of a deep colour twice daily; puerile respiration under left clavicle; respiration quite inaudible, and percussion dull in the lower half of thorax at both sides; duration of illness three months. Commenced with pain in abdomen in left hypochondriac region. R. Infus. junip. oz. vi. sp. junip. comp. oz. ss. aq. menth. oz. iss. tart. potass. oz. j. sum. oz. j. ter in die; pil. cal. et scill. ter in die. 29th. Three dejections daily; foot less swelled; urine much increased. 31st. Mittant. sang. oz. xij. cont. pil. et mist. Nov. 1. Blood not buffed; dyspnœa relieved; perstet. 3d. Ptyalism; left decubitus easier; swelling of abdomen rather diminishing; tormina; mist. mag. ter in die; omitt. cætera. 8th. Dyspnœa greatly abated; dull percussion as before; abdomen not much less than at first; rept. pil. cal. et scill. nocte; mist. junip. mane et meridie. 16th. Alvus tarda. R. Tart. potass. tinct. jalap: utriusque dr. ij. aq. menth. oz. j. *m.* ft. haust. statim sumendus. 17th. No effect from draught; haust. terebinth. 18th. Bowels freed; cont. pil. et mist. 27th. Lies in every direction without inconvenience; some portions of thorax at first dull on percussion, now clear; abdomen greatly reduced, nearly natural; pulse 76; cont. pil. et mist. In a few days he was dismissed free from swellings, and in the enjoyment of his usual health.

Hydrothorax is rather an unfrequent occurrence at the early periods of general dropsy produced by the causes already

enumerated. In those cases it is most usual towards the approach of death, or at least when the forces of the circulation are very much sunk. In several general dropsies, in which large quantities of fluid were found in the pleural cavities, I was certain, from repeated examination by percussion, that the effusion had not taken place till within a few days, or sometimes a few hours, before the fatal event; and in some instances it appeared that it must have occurred either during the last struggle, or subsequently to the death of the patient.

After pleurisy, however, hydrothorax occurs very commonly, either when the former has not been met by proper treatment, or has taken place in enfeebled subjects, or under circumstances causing relapses or aggravations of the inflammation. In some instances of even slight pleuritic seizures an effusion of serum rapidly takes place, and the death of the patient almost immediately ensues.

In a patient who lately came under my observation in Mercers' Hospital, of spare habit, greatly debilitated and emaciated from long-continued irritation of the stomach; there was no affection of the chest whatever; until one afternoon, when a cold breeze from an open door produced a pain in the left side, with slight cough, for which a blister and other applications were resorted to. His breathing continued unaffected till the following night, when his companions observed his rest to be disturbed, and he died early the next morning. On examination, the left pleural cavity was found filled with serum and masses of lymph of a gelatinous consistence, the lung being compressed towards its root against the spine. Death in this case was to be attributed to the suddenness of the occurrence rather than to its importance. When effusions of this kind take place gradually, the respiratory system is able to accommodate itself to the change, and the patient may endure it for a long time, even when it cannot be removed. As an illustration, I subjoin the following case.

Case XXI.

John Fea, a servant, aged forty-seven, admitted August 14, 1831. Pain in the back, shoulders, left side and head, aggravated by heat; a cough which occasions pain in the left side; dyspnœa, and a dragging pain in the left side caused by lying on the right; occasional rigors; pulse 76, weak; percussion dull on left side, both anteriorly and posteriorly; respiration puerile under right clavicle, and inaudible in left side. Complaint commenced with pain and cough about two months ago. Attributes it to cold contracted after being heated by a long walk. Hirud. xx. lat. sinist. pil. cal. et scill. tertiis horis; vesicat. axillæ sinist. potus tart. 17th. Severe pain in back last night. Mitt. sang. oz. x. cont. cætera. 18th. Blood not buffed; pulse 84; lies down with more ease, but not on his left side or back; cont. 21st. Hirud. xiv. lateri dolent. 22d. Cannot lie on left side or back; feeble respiration under the left

clavicle; ptyalism. R. Infus. junip. oz. vj. nitrat. potass. oz. ss. muc. g. Arab. tinct. scill. syrup. zinzib. singul. dr. vj. *m.*; sum. oz. j. ter in die; vesicat. lat. sinist. 23d. Pain in the left side gone; cont. mist. omitt. pil. 26th. No motion of the ribs on the left side takes place in respiration; no respiration to be heard on that side; percussion in the same universally dull; respiration in the right side puerile; pulse 88; severe pain at night along the spine; rept. venæsecto ad oz. x. pil. cal. et scill. mane; cont. mist. Sept. 13th. Hirud. xx. axillæ; cont. cætera. 14th. Pain abated; vesicat. axillæ; cont. pil. 17th. Tenesmus came on since last report; the pills were discontinued; moans at night; pain at lower part of left side; some respiration heard towards the spine, but only bronchial (i. e. in the larger air-tubes); other symptoms as before. Pil. cal. et opii h. s. m. sen. ad effect; hirud. xvj. reg. cord. 20th. Feels better; cont. pil. mist. junip, &c. 21st. Appears to have got cold; sonorous *râle* throughout right lung; severe dyspnœa; mist. cardiac. secundis horis. vesicat. sterno. 22d. Respiration easier: pil. cal. et opii statim et vesp. cont. mist. cardiac. cream of tartar whey. 27th. Since last report the respiration has been much relieved; pulse 88; lies on his back; ribs of left side not at all moved in respiration, those of the right side excessively so; percussion at left side universally dull; sleeps well at night; tongue coated; appetite gone; some diarrhœa the last three days. 28th. Died last night.

Necroscopia.—Left cavity of the pleura distended with serum containing shreds of organised lymph; lung thrust in towards its root, one adhesion alone remaining at the apex; pleura opaque; some red spots of vascularity on the diaphragm; lung nearly solid, sinking in water; heart thrust under the sternum; about two ounces of serum in the pericardium, and a large white spot on the surface of the heart, otherwise healthy; right pleural cavity nearly free from serum, with a few slight adhesions; right lung healthy.

In the above case the patient could not lie on the affected side, a circumstance to be attributed to the active inflammation of the diaphragmatic pleura of that side. Otherwise the general rule in pleurisy is, that in the first stage of pleurisy the patient lies on the opposite side; but when effusion has taken place to any considerable extent, then he lies on the affected side in order to keep the weight from the great vessels and opposite lung. I recollect to have met with only two cases in which there was no pain, and yet the patient could lie with comfort on the opposite side. In both, the fluid effused was confined to distinct cells of different sizes by strong adhesions, and was thus prevented from pressing on the great vessels at the root of the lung.

Effusion into the pericardium frequently occurs when the agony of death has been of long duration, and is thus often found to the extent of two or three ounces when no evidence of its existence had appeared during life. When of greater extent, and recognisable by symptoms, it is either the result of pericarditis, or connected with general dropsy; and in this latter case is not usual, except

when there has been disease of the valves. Sometimes it occurs in renal dropsy. With respect to its diagnostic symptoms, most of them are seen in the following case combined with those of open aortic valves.

Case XXII.

John Lyons, aged twenty-four, a tailor from Castlebar, admitted March 8th, 1833. Violent action of the heart; pulse 120, sharp, full; left decubitus easiest; right decubitus accompanied by a sensation of a weight falling from the direction of the heart; no pain produced by coughing; bounding of arteries; dull percussion to a considerable extent over cardiac region; an undulatory motion synchronous with the pulsation perceived there in the intervals of the ribs, and by pressure with the finger it is ascertained to be caused by the fluctuation of a fluid. Duration of present symptoms six weeks. Appears to have been caused by cold when suddenly getting up in a heat. Remembers from an early period to have been subject to palpitations. Mittant. sang. oz. xiv. R. Calomel granum; tart. ant. gr. $\frac{1}{4}$. digitalis granum; ext. gentian q. s. ft. pil. ter in die sumend. 9th. Pulse 96, softer; tenderness on pressure of the epigastrium below the region of the heart; rep. venæsectio. 10th. Cucurbit. reg. cord. mitt. sang. oz. xiv. 11th. Sleep improved and refreshing; pulse 100, still pungent; perstet. 12th. Nausea, and a sense of heat in the stomach; palpitations and irregularity of pulse when lying on right side; omitt. pil.; pil. cal. et opii meridie et vesp. tinct. digital. gutt. x. ter in die; cream of tartar lemonade. 16th. Ptyalism; pulse 116; omitt. pil. haust. efferv. c. spir. nit. dulc. gutt. vj. secundis horis; pediluvium. 18th. Pulse 120; mist. ros. cathart. R. Tinct. digital. gutt. lxxx. sp. nitri dulcis dr. ij. mucil. gum. arab. oz. iv. aquæ oz. iij. syrupi dr. vj. *m.*; sum. oz. j. ter in die. 20th. Pulse 120, very strong and sharp; vesicat. reg. cord. cont. mist. 21st. Soreness of mouth preventing sleep; in other respects as before; hirud. vi. infra maxillam; aceti opii gutt. xx. in haust. efferv. h. s. cont. mist. 22d. Pulse 94, less full; slept better; soreness of mouth less. 26th. Pain shooting from the sternum towards the left lumbar region; perstet. 29th. Pil. cal. et scill. h. s. cont. mist. 30th. Delirium during the night, with fits of insensibility; is unable to speak, but seems in pain; vomiting and diarrhœa; mittant. ex arteriâ temp. sang. oz. x. R. Mist. card. oz. vj. tinct. opii. dr. j. aq. menth. oz. ij. *m.* oz. j. secundis horis; vesicat. scrob. cordis. 31st. Pulse 120, sharp but compressible; vomiting has ceased; diarrhœa continues; does not speak, but appears in pain; head not hot; lies on both sides and on his back; abrad. capill. vesicat. nuch. cont. mist. April 1st. Died last night.

Necroscopia.—Above a pint of clear serum in the pericardium; serous membrane covering the heart towards its apex opaque; aortic valves thickened, so as to cause an open space in their central point of meeting; mitral valves thickened, yet not so as to

contract the opening, or to impede their function; left ventricle much hypertrophied; at the upper surface of the brain several spots of ecchymosis, and considerable vascularity; more fluid than usual in the ventricles; no morbid appearances observed in any other part.

The symptoms which occurred in all my cases of effusion into the pericardium were, inability to lie with ease on the right side; starts during sleep; fulness of the epigastrium under the pericardium; dull percussion over the the lower part of the cardiac region. The above symptoms always preceded, and often accompanied, by great frequency and pungency of pulse, with pain in the region of the heart; the latter not much increased by full inspiration as in pleurisy, but much aggravated by exercise. In several, the fluctuation of the fluid in the pericardium was visible through the integument, and by an experienced finger could be ascertained to be fluid, and not the movement of an enlarged heart; and in two instances the patients described a sensation as if a foreign body was underneath them when they lay on the left side.[1]

This disease is generally tedious, and often refractory to treatment. The best results in my experience were obtained from pills of calomel and digitalis, of each a grain, and extract of the acetum colchici two grains, to be taken thrice daily, along with frequent leeching and blistering over the region of the heart. When the heart's action was marked by unusual strength and violence, quarter-grain doses of tartar emetic were combined with calomel. In all cases the question of general bleeding was decided by the strength of the pulse, and the effects of it, as before observed. Purgatives, although often necessary, yet when used so as to produce irritation of the stomach and flatulence in the colon, cause great distress. Under those circumstances a draught of a quarter of a grain of watery extract of opium, and twelve drops of aromatic spirit of ammonia in camphor mixture, afford much relief. In general it is advisable, as much as possible, to withhold opiates for the procurement of sleep, as they mask the real state of the patient; and until the excitement of the circulation has been to some degree lowered, produce only a stupor with uneasy dreams prejudicial both to comfort and the favourable progress of the case. When however in this stage sleep has been much interrupted, it may often be procured without any disadvantage by either two grain doses of Dover's powder every three hours, or one eighth of a grain of acetate of morphine at the same interval, beginning in the afternoon, and aided by the pediluvium at night.

Hydrocephalus.—This disease, which is still best understood by the public under the name *water on the brain*, is yet so little of a dropsical nature, that in many cases no fluid whatever, but on the

[1] Here it is not intended to give a diagnosis of pericarditis so much as of hydrops pericardii. For an account of the sound produced when shreds of lymph are formed in the pericardium, see Dr. Will. Stokes's paper in the Dublin Medical Journal.

contrary an unusual dryness, is found in the ventricles. A late eminent practitioner of this city, who was well aware of this fact, was known, when attending *post mortem* examinations in this disease in presence of the patient's friends, to keep a sponge filled with water concealed in the palm of his hand, in order to afford a ready supply whenever the ventricles were empty. Nor is this error of believing the disease to consist in a collection of fluid confined to the non-medical portion of the public. Much light has been diffused on the subject since the publication of Dr. Quin's work, and we have many excellent practical treatises on it; but the confusion which still prevails as to its pathology and peculiar symptoms induces me to take this opportunity of stating my views on the subject.

There are three seats of disease within the cranium, which, although often simultaneously affected, and so giving rise to numerous complications, yet by comparison of individual cases may be proved to produce the following symptoms.

1st. The membranes of the brain, when affected (as in arachnitis), are the seat of pain more or less intense, which is increased by pressure, like that of all inflamed serous membranes, as may be tried by coughing or sneezing. When inflammation has proceeded to a certain extent, then so large a quantity of fluid may be effused within the cranial cavity that the space occupied by the blood-vessels is so much curtailed that the necessary circulation cannot be carried on, and coma ensues.

2dly. The cortical structure, when inflamed, causes delirium. The frequency of delirium in arachnitis arises from the proximity of the membranes to the cortical structure, in consequence of which excitement of the former is readily extended to the latter. For the changes of the cortical structure which have been observed in mental diseases, see the work of Dr. Foville.

3dly. The medullary structure is the seat of paralysis, when either pressure or disorganisation of it has taken place: when not thus affected, but irritated, then convulsions are the result.

Those principles will be found to furnish a clue, by which we may diagnose most affections of the head, and also satisfactorily explain the apparent exceptions.

Hydrocephalus, although not dropsy of the brain, as held by the older writers, nor phrenitis, yet is different from arachnitis, with which the moderns have endeavoured to identify it. It is to be distinguished from arachnitis first by its seat, which is not the membranes, but the substance of the brain; and secondly, by its symptoms. In it the septum lucidum is soft, so as not to be capable of being demonstrated, while the fornix and commissures are of the consistence of thick cream. The strabismus which occurs towards its termination belongs to no other disease of the brain, and appears to arise from the disorganisation now mentioned, by which the connection between the hemispheres is dissolved. Again, the disease forms in a gradual and often unperceived manner, such as might be judged to belong to slow disorganisation of the brain; and the

febrile attack, for which medical assistance is usually too late invoked, is only its termination. This, it is true, is generally attended with arachnitis, and consequent serous effusion; but the judgment as to the mode of its formation and probable fatal tendency is always to be formed from the existence of the previous symptoms.

The following case is subjoined as a specimen of this disease, presenting its most important features.

Case XXIII.

Master A., April 6th, 1833. Is in a state of insensibility; strabismus; eyes partially closed; conjunctiva of right eye suffused; pupils dilated. On exposure to light, the pupil of the right eye contracts, while that of the left continues dilated. Face appears drawn towards the left side; moanings frequent and half suppressed, resembling those of a person labouring under night-mare; seems slightly conscious when the head or any part of the body is touched; and when a moxa was applied, the motion of the hands and convulsive curl of the mouth to the left side indicated a sense of pain; pulse 120, weak; bowels confined; occasional hiccup; an accumulation of froth around the month.

Is reported to have been ailing the last three weeks, his complaint having been considered as a bilious fever. During nearly four months previously, he has been observed to be more reserved than usual. He absented himself from his accustomed amusements, and confined himself within doors. He constantly kept near the fire. He also used to complain of a pain in his right temple, and of his sleep being disturbed by frightful dreams. While reading some time ago, he suddenly started up and said that something like a film had come over his eyes. Insensibility came on unexpectedly yesterday. Leeches, blisters, and moxas, have been applied, and he has taken forty grains of calomel; enema statim; lotio frigida temporibus; cal. gr. iv. quartis horis. 7th. Copious dark coloured dejections passed involuntarily; sumt. cyanureti hydrar. grs. omni hora. ad 6 *m.* vicem. No change in the symptoms took place, and he died on the following day.

Necroscopia.—Head: between the arachnoid and pia mater towards the occiput in both hemispheres an effusion of bloody serum. Substance of brain with red dots more than natural. Softening of the lower surface of the fornix, and an almost complete obliteration of the septum lucidum. About two ounces of transparent serum in the left ventricle, none in the right; the lining membrane of the left ventricle unusually distinct and easy to be separated.

No examination of the abdomen would be permitted.

The preparatory stage, which was well marked in the above case, is at an earlier period of life denoted by frowning without any extrinsic cause, by starting from sleep, or by frequent application of

the hand to the head, with general dulness, or peevishness. In younger subjects also strabismus occurs at an earlier period.[1]

Although the evidence before me points out strabismus as a symptom of disease of the central part of the brain, yet I have seen recoveries after it has occurred, and very lately I observed it in a gentleman about twenty years of age, while in a state of coma, in a fever, of which he recovered. In this case however the symptoms bore a resemblance to those of hydrocephalus, and during several weeks before the febrile attack, he was observed to keep to the fire, and to be unusually silent and fond of solitude.

In another case which occurred lately of what was considered hydrocephalus in a child, but which wanted this distinctive mark, viz. strabismus, on examination after death, much fluid, but no softening of any part of the brain was found.

That form of chronic hydrocephalus which is attended with enlargement of the head, and opening of the sutures, is to be considered as chronic arachnitis, in which the stage of coma is postponed by the increased room afforded by the effused fluid. Those cases have become much more rare than formerly, in consequence of the attention to the state of the bowels, and other improvements in the management of children which have become general of late years.

For the treatment of the preparatory stage of hydrocephalus, I am enabled to recommend repeated mercurial purgatives, blisters behind the ears, and if there be heat of the head, leeches. By these, and similar means, the progress of the disease is easily arrested, while on the contrary, if suffered to proceed to the latter stages, it is all but hopeless.

In the latter stages, leeches, counter-irritants, and mercurials, are our most valuable means. In some cases I used the cyanuret of mercury, which although apt to nauseate, yet has the effect of producing salivation with rapidity, and is destitute of either acrid or narcotic qualities. Sinapisms made of strong mustard and water, without any addition, and applied to the back of the head, or in bags enveloping the feet and ankles, are far superior to blisters in rousing from coma. With regard to opiates an unfounded prejudice exists; they are imperatively required, whenever, notwithstanding the use of the remedies now mentioned, wakefulness continues constant. In case of sleep disturbed by moans or starts, the patient should be awakened, as that state produces more fatigue than the rest, and small doses of Dover's powder will then be sometimes found to change this restless sleep into refreshing slumbers, with improvement of all the symptoms.

[1] To avoid misconception, let it be remembered that there is strabismus, 1st, in early infancy, before the eyes have been accustomed by habit to move in the same axis; 2d, in some, when not looking with sufficient attention, or in laughing, &c.; 3d, in irregular gout from affection of the muscles of the eye; 4th, in some, in a permanent form, from habit: all of those are to be distinguished from the above.

ON

DISEASES OF THE BLADDER.

BY WILLIAM COULSON, SURGEON.

ADVERTISEMENT.[1]

In the following pages my chief object has been to establish clearly, the distinction between the inflammatory diseases which attack the several coats of the bladder. It has appeared to me important, that these affections should not be confounded under the general character of inflammation of the bladder, as not only are they distinguished from one another by their symptoms and progress, but as each of them requires an essentially different treatment. I have also considered irritation, paralysis, and some other disorders of the bladder, as they stand in close connection with inflammation of this organ.

The substance of the chapters on inflammation formed the subject of the oration delivered this year to the Hunterian Society.

Frederick Place, Old Jewry, March, 1838.

CHAPTER I.

IRRITABILITY OF THE BLADDER.

This term is usually employed to denote any affection of the bladder which is attended with frequent desire to void the urine. I wish, however, to express by it, a frequent and often irresistible desire to void the urine, sometimes, but not always attended with pain, and not arising from inflammation or any of the organic affections of the bladder or prostate gland.

The frequent desire to pass the urine is the chief symptom of this complaint. A person having enjoyed good health, feels suddenly a desire to void urine every half hour, or oftener; and the desire is so strong, that unless he yields to it at once, the urine passes without his being able to prevent it; or if he succeeds in checking the desire, uneasiness or pain, or even paralysis of the bladder, is apt to occur. The voiding of the urine is sometimes,

[1] On Diseases of the Bladder. By William Coulson, Surgeon. 12mo. pp. 153. Lond. 1838.

but not always, attended with pain in the glans penis, or under the frænum, and with violent efforts or straining.

The urine is voided (except in hysterical subjects) in small quantities; and although such quantities are frequently passed, the aggregate does not much exceed that of a person in health. It is necessary to bear in mind that the quantity of urine passed in twenty-four hours by a person in perfect health, varies even when he makes no difference in his mode of living or exercise. Rye considered forty ounces an average quantity in the twenty-four hours; whilst Dr. Prout reduces it to thirty-two. The number of times a healthy subject discharges urine is also uncertain, usually varying from six to fourteen times; and occasionally a person in good health will be found who passes urine only twice in twenty-four hours. Hysterical patients sometimes suffer from irritable bladder, and experience great pain in passing urine. In these patients, the quantity is often considerable, and possesses the peculiar character designated by Dr. Bostock[1], "aqueous," containing less than the usual proportion of solid matter, without any other change in the nature or relative quantity of its constituents.

Opportunities for examining after death the bladders of those who labour under idiopathic irritation of the bladder are exceedingly rare. I examined, with Mr. Woolterton, of Euston Place, the body of a gentleman, of a very nervous temperament, who had long laboured under irritation of the bladder, and who was carried off by an affection of the lungs, but we could not detect the least alteration in the appearance or structure of the bladder or any of the urinary organs.

After long continued irritation, the bladder becomes diminished in size, and instead of containing a pint or upwards, it is incapable of holding more than two or three ounces at a time. Notwithstanding this contracted state of the bladder, if there be no stricture or disease of the prostate, its parietes are often thinner than natural.

Irritation of the bladder often depends on obvious causes, as pressure of the womb in pregnancy, stricture of the urethra, hemorrhoids and foreign bodies in the bladder: after the operation for stone also, the bladder often remains in an irritable state. The bladder is liable to irritation in almost all cases of stricture; but, if there be no alteration in the structure of the organ, this subsides when the stricture is removed. Sometimes the slightest derangement in the digestive organs will, by disturbing the functions of the kidney, cause irritability of the bladder. Adults, and children, more particularly, are, from eating fruit, very liable to this affection in the summer season. In these cases, the urine contains an excess of acid, either of the lithic acid, or of the lithate of ammonia.

Sometimes it is produced by taking for too long a time alkaline remedies; and, in this case, the urine is of course alkaline. I was consulted for irritability of the bladder by a gentleman, whose urine was alkaline, but whose appearance, and state of constitution did not

[1] Cyclopædia of Practical Medicine, vol. iv. Article, Morbid condition of Urine.

at all lead me to expect this condition of the urine. On enquiry, I found that he had for a long time been taking the sesquicarbonate of soda in large doses. I ordered him to discontinue the use of this medicine, and he soon recovered. The altered state of the urine is the immediate cause of this complaint; and, in these cases, the condition of the urine should especially engage our attention.

Gouty and rheumatic persons are frequently subject to this complaint. A patient having irritability of the bladder, applies to his medical man, who, on enquiry, finds that he is occasionally subject to pains in the limbs and loins, to some scaly eruption on the skin, and sickness of a morning. The urine is usually passed in small quantities, is very acid, and contains a large quantity of the lithate of ammonia.

The following case illustrates this common form of the complaint. A gentleman forty-two years of age, and subject to rheumatism, applied to me on the 11th of February, 1837, on account of a very frequent desire to pass urine, from which he had suffered for several years. There was a scaly eruption on several parts of the body, particularly about the elbows and knees, and he often felt severe pains in the hips and loins. The urine was very acid and scanty. I ordered him the following mixture:—R. Infus. diosmæ ʒxv.; Tinct. hyoscyam. ʒiij.; Potass. bicarb. ʒiss.; Extract. fluid. Sarsap. ʒiv.; Cap. coch. ij. vel iij. ampl. ter in die. And I gave the following pill at bed time: R. Pil. hydrarg. gr. iij.; Pulv. rhœi. gr. ij. On the 3d of March, the irritability of the bladder was much lessened, and the eruption improved. I then gave the decoction of the pareira brava in the day, with a grain of the acetous extract of colchicum at bed time. His complaint was much relieved, but not cured.

Scybala in the intestines will give rise to this complaint.

For practical purposes,[1] it is sufficient at present to observe, that there is not only a sympathy betwixt the bladder and the other parts contained within the pelvis, by which the diseases of one may be mistaken for those of the other; but certain parts of the intestinal canal through its whole extent, sometimes the stomach, sometimes the ileum, often the colon, and still oftener the rectum, being the seat of irritation, will produce sensations in the bladder, the perineum, or urethra. These will fill the mind of the sufferer with the most serious apprehensions, and lay him open to the mistakes of ignorance.

Various mental emotions, as grief and anxiety, cause this complaint, and it is often connected with a peculiar state of the nervous system. "An elderly man, for example," says Brodie,[2] "complains of frequent attacks of giddiness. In walking his head turns round, so that he is in danger of falling; and this symptom probably arises from an altered structure of the arteries of the brain, causing an imperfect state of cerebral circulation. Not unfrequently this is

[1] Bell's Institutes of Surgery, vol. i. p. 279.
[2] Lectures on the Urinary Organs, 2d edition, p. 75.

attended with an irritable state of the bladder; and although the urine is of a healthy quality, and the bladder itself is free from disease, the patient is tormented by a constant micturition, voiding his urine without pain, but at short intervals, and in small quantities at a time."

I have known irritation supervene on paralysis of the bladder. A gentleman, during an attack of typhus fever, nine years ago, was seized with an inability to pass urine, requiring it to be drawn off twice a day. However, as he gained strength, the power of voiding the urine returned, but the desire to pass it became then so frequent as to compel him to go every half hour. He consulted me for this symptom on the 25th of November, 1835. There was no disease in the urinary organs, and his general health was good, with the exception of occasional rheumatic attacks. The urine was very acid and scanty. I ordered him a grain of the acetous extract of colchicum at night, and ten grains of bicarbonate of potass, seven of sesquicarbonate of soda, and four of the nitrate of potass, twice or three times a day, soon after his meals; and by these means the urine became more abundant and less acid; but the frequency of passing the urine continued the same. I then tried the infusion of diosma, the decoction of the pareira brava, and various preparations of steel for the relief of this symptom, without success.

This complaint is, in many cases, likely to be mistaken for some of the inflammatory affections of this organ. The distinction, however, is easy, and of great practical importance. If the complaint has recently occurred, it may be distinguished from the acute inflammation of the bladder by the absence of pain and of those severe constitutional symptoms which belong to the latter complaint. If, on the other hand, it has been of very long standing, the general health suffers but little; whereas, in chronic inflammation of the bladder, the constitutional powers sooner or later give way. In the following case, the health was but little affected, and the complaint was of very long duration.

A gentleman sixty-five years of age, of a good constitution and regular habits, consulted me on the 4th of December, 1835, on account of a very frequent desire to pass his urine, unaccompanied with stricture or disease of the prostate, or any other affection that I could detect. Thirty years ago he applied to Mr. Jesse Foot, for the same complaint; and the lotura vesicæ was then tried on him without any relief. This symptom has continued ever since, being aggravated in cold weather, and on any excess in living or derangement in the health. In other respects, he is quite well.

The cause of the irritability is sometimes supposed to be confined to the bladder, when in fact this organ is not at all affected, but the kidneys are the source of the complaint; and these cases are attended with great obscurity.

Morgagni[1] relates a case in which the bladder was the seat of sympathetic pain; the disease being in the kidneys. The patient,

[1] On the Seats and Causes of Disease, Letter 42.

he says, complained of very little pain in the region of the kidney; while he was tormented with pain in the bladder, so excruciating that five or six physicians who attended him, entertained no doubt that the seat of the disease was in that organ. On dissection, however, no morbid appearance was discovered in the bladder, but there were large and ramifying calculi of the kidney.

In certain renal affections in particular habits, says Dr. Prout,[1] even where the urine is not very unnatural, the pain is confined chiefly to the neck of the bladder; but when the urine is actually diseased, and more especially alkaline, we may be certain that the kidney is functionally, and if the patient be of a scrofulous habit, and the case of long standing, very probably organically affected.[2]

Where a case of irritability of the bladder comes under the notice of the surgeon, the first and great object of enquiry, is the cause on which the irritation depends. In many cases, the causes are obvious, as in stricture, foreign bodies in the bladder, &c. on the removal of which the irritation subsides; in other cases, the exciting cause is involved in great obscurity, and the complaint continues in spite of all the remedies which we employ.

In idiopathic irritability of the bladder, where it has not been of long continuance, the treatment is usually plain. The state of the general health and the condition of the urine must be our guide. In gouty and rheumatic subjects, where the urine is generally acid and scanty, and red sand is often passed, the alkalies should be administered; and a good form for their exhibition is a combination of the potass, soda and nitre.[3] Dr. Prout recommends the carbonate of potass, in preference to the carbonate of soda, because the soda, under certain circumstances, enters into combination with the lithic acid, forming an insoluble salt, as bad as the lithic acid itself, whereas the lithate of potass is perfectly soluble, and if this combination should take place, it will pass off dissolved in the urine. In addition to the alkalies, the acetous extract of colchicum, in[4] doses of one or two grains at bed time, should be given; and if the digestive powers be weak, as is often the case, some tonic as the infusion of cascarilla, or columba, or hop, will be found serviceable a short time before meals.

In these and indeed in all cases, the strictest attention should be paid to diet; vegetables and fruit should be avoided, as well as wine, spirits and all fermented liquors. In some constitutions, notwithstanding the acid state of the urine and the deposition of a

[1] Inquiry into the Nature and Treatment of Diabetes, Calculus, &c. 2d edition, p. 315.

[2] Some interesting cases of irritation of the bladder caused by disease of the kidney are related by Mr. Henry James Johnson in the Medico Chirurgical Review, vol. xxix. p. 193.

[3] R. Bicarb. potass. ʒj.; Sesquicarb. sodæ, ʒvj.; Potass. nitrat. ʒij. As much of this powder as can be put on a sixpence, to be taken twice or three times a day, in water, soon after a meal.

[4] R. Extract. aceti colchici, gr. j. vel ij.; Pulv. glycyrrhizæ, q. s. A pill to be taken at bed time.

large quantity of the lithate of ammonia, the alkalies disagree, producing restlessness, giddiness, and uneasiness about the region of the stomach.

I recently saw, with Dr. Prout, a gentleman who had great irritability of the bladder, and whose urine was very acid and deposited great quantities of the lithate of ammonia, but who could not bear even small doses of alkaline remedies.[1]

If the patient be of a nervous temperament, and the urine be alkaline, a different plan of treatment will be necessary. The dilute mineral acids,[2] combined with the decoction of pareira brava, should be administered, and every thing that has a tendency to lower the system, as attention to business, study, or anxiety, should be studiously avoided. In other cases, where the urine is neutral, the extract of the uva ursi,[3] combined with extract of hop or hyoscyamus, may be taken, and opiate suppositories,[4] or injections with some drops of the liquor opii sedat. according to the severity of the symptoms, may be administered. The decoction of uva ursi,[5] and the infusion of wild carrot seeds,[6] will occasionally give great relief. But, in my experience, no medicine has been so often successful in irritability of the bladder, as the diosma in the form of an infusion.[7] I could cite several cases, where it has succeeded after other medicines had failed. A young gentleman, æt. 21, applied to me, May 25th, 1834, on account of an affection of the bladder; and said that, for the last eleven or twelve years, he had experienced great difficulty in retaining his water for any length of time, being obliged to leave any company in which he was, once or oftener in the hour. The moment the desire to pass the urine came on, the water passed away involuntarily, unless the desire was immediately complied with. This irritability of the bladder was always very much aggravated after taking malt liquors, wine, spirits, and on exposure to cold, and had considerably increased during the last twelve months. He was very susceptible of cold, complained of pains down the inside of the thighs, but he had no pain in the region of the loins

[1] In such cases the following mixture may be given. R. Spirit. ammon. aromat. ʒij.; Spirit. æther. nit. ʒij.; Tinct. Hyoscyam. ʒij.; Mist. camph. ʒv. A fourth part to be taken three times a day.

[2] R. Acid. nitric. dil. ʒi.; Acid muriat. dil. ʒss.; Aquæ distillat. ʒviij. Two tablespoonsful to be taken three times a day.

[3] R. Extract. uvæ ursi gr. v. Extract. humuli vel hyoscyam. gr. iii. Two pills to be taken three times a day.

[4] R. Pil. Saponis cum opio gr. vij. To be introduced within the rectum at bed time.

[5] R. Folior. uvæ ursi ʒi.; Aquæ ferventis ʒxx.; coque ad ʒxvi. A third part of a pint to be taken three times a day.

[6] R. Seminum dauci contusorum ʒi.; Aquæ ferventis ʒxvij.; Macera per horas iv.; dein cola. A third of a pint to be taken three times a day.

[7] This is to be prepared according to the formula in the London Pharmacopæia. If there be scaly eruptions, and the urine very acid, the following form will be found of service: R. Infus. diosmæ ʒvij.; Potass. bicarbon. ʒi.; Tinct. hyoscyam. ʒiiss.; Extract. Fluid. Sarsap. ʒiv. Two table spoonfuls to be taken three times a day. If the urine be not very acid, the alkali must be omitted.

on pressure nor over the bladder, and his general health had not suffered. The urine was light coloured, and neutral in its character. After trying the various preparations of steel, the decoction of the pareira brava, henbane in different forms, without success, I ordered the infusion of diosma, which he took for some time with great benefit.

Mr. Jesse Foot, as is well known, was a great advocate for injecting the bladder in cases of irritation of this organ, but the plan since his time has never been extensively tried. Mr. Wadd mentions two cases in which great relief was experienced from the lotura vesicæ, and expresses his surprise that it is not more resorted to by practitioners.

In the irritability of the bladder which is met with in young females, just at the time when menstruation may be expected, or when some irregularity in this function has occurred, the preparations of iron are of great service. The ammoniated or the muriated tincture of iron, given in some light bitter infusion, will be found serviceable; and if the bowels be costive during the use of this remedy, the compound decoction of aloes should be daily administered. The bowels should be kept well open, for the symptoms of the disease are invariably aggravated when the bowels become costive. If there be much hysteria, the tincture of valerian, combined with the vinum aloes, may be also tried with benefit.

Incontinence of urine in children usually depends on an excitable state of the bladder, or an altered condition of the urine. It occurs during sleep, and the urine is often passed off voluntarily under the influence of a dream. In other cases, it is more of a passive character, and passes involuntarily. In some cases, this involuntary passing of the urine continues by day as well as by night, and then the patient suffers more or less from this complaint during the remainder of his life. In such cases, the children should be waked up in the night, twice or oftener, for the purpose of passing the urine; and they should not be allowed to take late meals, or much liquid for some time prior to retiring to rest. In fact, they should not, at any time, be allowed to take much liquid. Lying on the back in bed tends to keep up this complaint, and should be guarded against. Cold bathing, preparations of iron, and other tonics, will be found of great use. If the complaint continues after puberty, the tincture of cantharides is often very serviceable.

It is frequently connected with a weak and scrofulous state of constitution; and in these cases, all remedies are often unavailing. I lately saw a child six or seven years old, with a large head, pale countenance, bad teeth, prominent sternum, large abdomen, and emaciated extremities, who had suffered from incontinence of urine from its earliest infancy. All kinds of remedies had been tried without any success. I may just observe that, in this case, as well as many others, there was great irritability of the bladder during the day time, and, unless the desire to pass the urine was attended to, it flowed off involuntarily. The urine was very acid.

Incontinence of urine is sometimes the effect of stricture in the

urethra, and will subside on the cure of the stricture. In other persons, particularly stout females, the urine will flow involuntary on lifting a weight, or coughing, or any violent exercise. In these cases there is no pain, no blood in the urine, no desire to make water often, simply the involuntary flow on exertion, the action of the diaphragm, and abdominal muscles overcoming that of the sphincter of the bladder. In females, it often occurs after distension of the urethra for the extraction of calculi or foreign bodies, and occasionally after difficult labours.

CHAPTER II.

PARALYSIS OF THE BLADDER.

This is the opposite state of the bladder to that which we have just been considering, although one sometimes supervenes on the other.

Partial paralysis of the bladder may exist for some time without exciting attention, a sufficient quantity of urine flowing from the bladder without its being perfectly emptied.

But when more complete paralysis supervenes, and the patient has not lost all sensibility, he complains of great uneasiness and oppression or weight in the region of the bladder, and finds himself incapable of voiding urine, notwithstanding all his efforts to do so.

This complaint comes most frequently under the notice of the surgeon as the effect of the injuries or diseases of the spine; and these cases are attended with important changes in the condition of the urine, as well as the whole urinary system.

"In some cases," says Brodie,[1] "the urine which is first secreted, although of an acid quality, and free from mucus, has a peculiarly offensive and disgusting odour. In other cases, the urine is highly acid, having an opaque yellow appearance, and it deposits a yellow amorphous sediment. But the most common change produced in the urine by an injury in the spinal chord, is the following. It is voided of an ammoniacal odour, and turbid; when allowed to cool and remain at rest, it deposits a large quantity of adhesive mucus; and, when tested with reddened litmus or turmeric paper, it is found to be highly alkaline. After some time, a quantity of white matter (phosphate of lime) may be detected in the mucus, and it is tinged with blood. At a still later period, a considerable quantity of coagulum of blood is blended with the mucus and urine."

An opinion has been entertained that the ammoniacal condition of the urine in these cases is owing to imperfect nervous power influencing the kidneys, and that, when the spine is hurt, and there

[1] Medico-Chirurgical Transactions, vol. xx.

is consequently paralysis, there is a changed condition in the secretion of urine. Mr. Curling, in a paper published in the Medical Gazette, contends that the condition of the urine and of the bladder are the direct result of the paralysis.

Dr. Burne, in reply to this view, says, "in all the cases witnessed by myself, in which ammonia has existed in the urine, there has been sufficient grounds for attributing its presence to the decomposition of the urine in the bladder. I have long been of opinion that its source is in this organ, and that it does not arrive ammoniacal from the kidney. Independently, indeed, of clinical evidence, there is extreme difficulty in supposing ammonia to be derived from the kidney, seeing that the kidney itself is not affected by it, while the bladder becomes most seriously diseased; and yet the organic sensibility of the mucous surface of the kidney is precisely similar to that of the bladder; both are adapted to the stimulus of healthy urine, and both would be equally affected by any foreign irritating ingredient. Supposing for a moment, that disease was excited in the kidney, suppression of urine would ensue as a necessary result of the inflammation; but the urinary secretion is not arrested, a proof that the kidney is not involved, except it may be slightly and sympathetically."

If then, in cases of ammoniacal urine, the kidney remains sound, while the bladder becomes diseased, it follows that the ammonia cannot be present in the urine coming from the kidney; and further, that the ammonia must be formed in the bladder.

This question is altogether one of great importance, and requires further observation before it can be determined. If the first opinion alluded to be correct, little relief can be afforded excepting in so far as the paralysis itself may be relieved. On the other hand, if the evolution of ammonia and the inflammation of the bladder be the effect of the retention, the prospect is more cheering.

Lallemand observes,[1] that we must ascribe to a diminution of sensibility, the distension of the bladder and the inflammation of its mucous membrane, observed in diseases of the brain and its membranes, when such diseases are accompanied with stupor, drowsiness, &c. The patient makes no effort to expel the urine contained in the bladder, because he does not feel the impression made by it; it consequently accumulates and distends the parietes of this organ as long as they admit of it, until the resistance which the urine experiences from them, being greater than that presented by the neck of the bladder, the urine dribbles away in the same proportion, and with the same slowness, as it is conveyed by the ureters—that is, drop by drop.

This complaint often attacks elderly persons, particularly gouty and rheumatic subjects, and is the result of general diminution of muscular and nervous power, the bladder being incapable of obeying the will with the same facility as before, and being less sensible to the stimulus of the urine.

[1] Letter ii. p. 236.

It is also often brought on by neglecting to expel the urine when it is accumulated. A person, not being conveniently situated for emptying his bladder, neglects the first call, and allows it to become distended; the desire perhaps goes off; a large quantity of water accumulates; the bladder rises up to the umbilicus, or even higher; and when he attempts to empty it, he finds he is totally unable to do so, and that he cannot void any water at all.

Patients ought never to resist the first desire to make water; for, in not obeying this inclination, the bladder distends; the elongated fibres lose more and more their sensibility; the desire to make water passes off; the retention, which, in the commencement, was only partial, then becomes complete; and there is no stimulus sufficiently strong to excite the bladder to expel the urine which it contains.

When the bladder is distended to a certain degree, the urine flows off involuntarily; and, at this stage, it has happened, that the paralysis of the bladder has been overlooked, especially in corpulent persons, and incontinence has been supposed to exist, whilst, in reality, the bladder was full and could hold no more. In the case, therefore, of a person who may complain of not being able to hold his water, especially an old person, and when the water is flowing off involuntarily, the surgeon ought not to give any opinion about it till after he has, at all events, laid the hand upon the abdomen, and felt whether the bladder is distended or not, for very serious consequences may be produced by a mistake of this kind. In illustration of this important subject, Mr. Lawrence mentions the following interesting case:—"It happened to me, a good while ago, to be sent for, to see a gentleman labouring under an affection of the bladder; and the medical attendant who had lately seen him, mentioned that the case was one of great irritability of the bladder—that it would hold no water at all—the urine passing off as fast as it came into it. He said he had been doing all he could to get the natural power of retention of the bladder restored; he had directed the patient to take diluent fluids; in short, he had done all he could to prevent it; but still the water ran off. It appeared to be a singular case. I put my hand under the clothes upon the abdomen, and I felt the fundus of the bladder forced up a good way above the umbilicus; I said I had brought a catheter with me, and that I might as well introduce it, to see if there was any thing in the bladder. I introduced it, and about five pints of urine immediately flowed out. The fact was, the bladder had been allowed to distend in this way for about five days before I saw him; and the consequence was, that that gentleman never recovered the natural power of emptying the bladder afterwards; but he, after a certain time, acquired the art of introducing the catheter, which he still employs. He can introduce it, and let off the water whenever he finds a desire to do so; but he never has been able to empty the bladder by the natural powers since that time."

If, by the use of the catheter, the bladder should recover its

natural power, the patient must be strongly impressed with the importance of never again allowing the urine to accumulate to such an extent, but immediately, and as often as he feels the smallest inclination, to pass urine, or if unable to expel it, to make timely use of the catheter. The patient ought also to be informed of the necessity of voiding the urine on every occasion to the last drop.

Although the complaint is often met with in old persons, it not unfrequently occurs in persons under thirty-five or forty years of age, whose constitutions have been impaired by venereal excesses, long courses of mercury, anxiety, fatigue, and over attention to business. Prior to the attack, the patient complains of pain in the head, or some part of the back, weakness in the loins, and inability to walk firmly; flatulence, or a sense of fulness in the region of the epigastrium; and he looks and feels as if threatened with some impending mischief. If these symptoms be not relieved, paralysis of the lower extremities follows, and his bladder partakes of the affection. I recently attended, with Mr. Ireland, of Artillery Place, a case of this kind, which terminated fatally in eight weeks. The use of the catheter twice, or occasionally three times a day, was required from the commencement of the illness. At first, the urine was of a deep red colour, very acid, and without mucus; towards the close of the illness, mucus was secreted in abundance, and the urine became alkaline. I have known, however, paralysis of the bladder occur where the previous habits were regular, and the state of health was in other respects good. With Mr. Dunn, of Norfolk street, I last year attended a gentleman about thirty years of age, extremely nervous, who had been labouring under considerable mental excitement. We were sent for to this gentleman, suddenly, on account of retention of urine; the urine was drawn off by the catheter, and this was repeated twice a day for ten days, at the end of which time the power of the bladder returned, and he was able to make water himself. The retention arose entirely from a paralysed state of the bladder, owing to diminution of nervous power; there was no stricture, or gonorrhœa, or local impediment to the passage of the urine.

Paralysis of the bladder comes on in typhus fever, some cases of compound fracture, or severe injuries of the lower extremities. In the case of a lady on whom I operated for hemorrhoids, the bladder became paralysed, and she required the use of the catheter for some days before the bladder recovered its usual power.

Paralysis of the bladder occasionally occurs from the use of opiate suppositories, or injections; so that it has been necessary to draw the water off, and much alarm has been occasioned by it.

I may allude to a few of the causes which deprive the bladder of the power of expelling the urine, although the bladder cannot be said, under these circumstances, to be in a state of paralysis.

The rectum may be distended by flatus, blood, morbid growths, or any foreign body; and in these different states, the neck of the bladder and the urethra may be compressed.

I last year attended, with my friend, Mr. Brown, of St. Mary Axe, a case of diseased hip joint, in which matter had made its escape from the affected joint into the pelvis, so as to press on the neck of the bladder, and had caused paralysis of this organ. On examination, after death, we discovered that the matter had escaped through the acetabulum to the posterior part of the bladder, close to its neck.

There are two periods in pregnancy[1] when women are particularly exposed to retention of urine—about the fourth month of pregnancy, and at the time of confinement. To have an exact idea of this state, it must be recollected, that, in the first month, as before conception, the womb continues concealed in the pelvis; that it does not mount above the cavity till the fifth month, and sometimes even later; that until that time, its size and weight having progressively increased, it descends lower towards the vagina, and, in the manner of a wedge, presses posteriorly the rectum, and anteriorly the neck of the bladder, and the urethra against the symphisis of the pubes, even to such a degree, as to stop the opening of this canal.

The displacement of the viscera, which so often gives rise to retention of urine, are retroversion of the womb and prolapsus of this organ, of the vagina and of the rectum. If we examine the intimate connection of the bladder both with the womb and vagina in the female, and with the rectum in the male, it is clear that the parts cannot be displaced without drawing with them the bladder; and that, in this displacement, whatever may be the contractile force, it cannot entirely expel the urine which it contains.

In the prolapsus and retroversion of the womb and vagina, and of the rectum, the posterior part of the bladder, instead of being carried upwards and forwards, is drawn downward and backward, and the curve of the urethra is entirely changed. Instead of presenting a concavity beneath the pubes, as in retroversion, the bladder presents there a convexity, a derangement which must not be lost sight of in the introduction of the sound.

The morbid appearances presented after death, are dilatation of the bladder, attenuation of its coats, and a pale white appearance of the mucous membrane; at least, these are the appearances found when the mucous membrane of the bladder and the kidneys have not been seriously involved in mischief, as after injuries of the spine. In this latter case, there is great vascularity of the mucous membrane lining the bladder, ureters, and the pelvis and infundibula of the kidney. The mucous surface of the bladder is thickened and of a slate colour, and presents, here and there, dark red spots. Sometimes the surface is covered with phosphate of lime, which has been deposited from the mucus, or a white powder is often found in the mucus itself, and the bladder contains some fetid urine.

In the treatment of this complaint, the first and immediate step

[1] Traité des Maladies des Vois Urinaires, par J. P. Desault, p. 160.

required, is to draw off the accumulated urine by means of a catheter; and the operation should be repeated twice, or even oftener, in the twenty-four hours, (at intervals sufficiently short to prevent over distension,) until the bladder has recovered its contractile power. If the complaint has not arisen from organic mischief, and the patient is not very old, recovery may be expected to take place; and as the bladder recovers its tone, the patient says he fancies he could pass a little urine; and on making the effort, voids some, either drop by drop, or in a small stream. As the recovery begins to take place, the catheter should be less frequently employed, until its use be entirely superseded. In other cases, particularly in elderly persons, the bladder never recovers its tone, and the use of the catheter will be required as long as the patient lives. In the paralysis of the bladder dependent on disease or injury of the spine, the catheter should be passed with the greatest care and caution, so as, on the one hand, to avoid injury to the mucous membrane, and, on the other, completely to empty the bladder.

These are points of the greatest importance, which, perhaps, have not always been sufficiently attended to in practice. Dr. Burne mentions, in the paper already quoted, a case in which, so long as the bladder was completely evacuated, the urine retained its natural character, and the bladder remained from disease.

To prevent any injury to the mucous membrane, a gum elastic catheter had better be used; and, at the time of passing it, pressure on the pubes should not be used, nor should I advise the catheter to be kept in the bladder, but it should be introduced on each occasion when the urine requires to be drawn off. Cases are on record where abscesses in the bladder and ulcerative perforations have been the result of the point of the catheter coming in contact with the bladder.

I need scarcely observe, that if, from any circumstance, as impermeable obstruction of the urethra, or enlargement of the prostate, the catheter can not be introduced, the life of the patient must not be endangered by delay; but the bladder must be punctured.[1]

The constitutional treatment in paralysis of the bladder, depends on the cause and the affection with which it is connected. In cases of disease or injury of the spine, of affection of the brain, and of general debility, the treatment required will of course vary.

A state of bladder occurs in hysterical females, nearly resembling paralysis; but it requires local treatment different to that which is adopted in other cases of retention. If left to themselves, these cases usually recover; but if we once begin to pass the catheter, its use will be for a long time required, and the complaint protracted. I recollect distinctly a case of this kind, where the catheter was, once or twice a day, introduced for some time, until at last an opinion was raised that the malady was either feigned or nervous, and that it would be desirable not to introduce the catheter.

[1] Vide Chap. iv. on the Subacute Inflammation of the Mucous Membrane, for the remedies best adapted to check the secretion of the mucus.

The young woman after this escaped from my notice, but I learnt that the affection of the bladder soon subsided. As a general rule in these cases, the catheter ought not to be introduced.

CHAPTER III.

ACUTE INFLAMMATION OF THE MUCOUS MEMBRANE OF THE BLADDER.

The symptoms of this complaint are, frequent desire to void the urine, accompanied with shooting throbbing pains in the region of the bladder, extending towards the urethra, and these are increased by pressure on the part, or any motion of the body. There is a sense of heat, or burning, along the urethra, and a dull pain just above the pubes; the desire to make water is urgent; and the pain which is felt in passing a few drops, is often compared by the patient to the passing of melted lead. It subsides after the urine has ceased to flow, but returns as soon as a little urine accumulates in the bladder. The pain is not only felt along the whole course of the urethra, but is referred to the lower part of the abdomen, immediately above the pubes, and shoots into the perinæum and down the thighs. The urine is generally acid, and varies in appearance, being sometimes of a lemon colour, at other times of a deep red; and on examining it in a transparent vessel, by the light, numerous shreds of lymph, or mucus, will be seen floating in it. At the commencement, the urine is not albuminous, but it usually becomes so in the progress of this, and, indeed, of the other inflammatory affections of the bladder. It is discharged in very small quantities, although the aggregate amount in twenty-four hours may equal the usual quantity. Sometimes there is sickness and uneasiness in the loins, which usually indicate that the kidneys are affected. The pulse is quick and small; the tongue white; the patient is thirsty; the countenance is anxious; the skin is dry, and often affected with some scaly eruption; the limbs are painful, with uneasiness and anxiety, augmented by the absence of rest, and by the constant desire to make water.

If the desire be not arrested in the early stage, ulceration of the mucous membrane occurs, and usually proceeds till the whole of the mucous membrane is destroyed. It is difficult to determine the existence of ulceration (except in cases where the fæces are passed by the urethra), and perhaps it cannot be certainly known during the lifetime of the patient; but there is always reason to suspect it when the disease of that organ has been of long continuance, when the pain is increasing and extensive, and when pus is distinctly detected in the urine. The ulcerative process is attended with constant pain and irritation, keeping up the desire to

void the urine, which is never suffered to accumulate; at the same time, increased difficulty and increased pain generally attend the passing of it.

Ulceration may extend so deep into the substance of the bladder as to cause perforation of its parietes; and cases are recorded of extravasation of urine taking place into the abdomen from this cause. In these cases, life is soon destroyed by the extension of peritoneal and cellular inflammation. But it usually happens, when the ulcerative process extends to the other tunics of the bladder, that it is accompanied by the effusion of lymph exterior to the ulcer, which thus glues the neighbouring parts together, and prevents the escape of the urine; and in this manner, a communication is sometimes formed between the ilium or sigmoid flexure of the colon and the fundus of the bladder, or between the rectum and the under surface of the bladder, in the former of which cases, the fæces pass into the bladder, and through the urethra; in the latter, the urine goes into the rectum, and is voided with the fæces.

Mr. Wilson[1] says, "I have preserved the bladder and ilium of a person, which had adhered fifteen years before the death of the patient. Ulceration to a large extent had taken place through this connected part; and for the whole of the above period, the fæces readily passed from the ilium into the bladder. The patient died when sixty-eight years of age. Being a female, the shortness of the urethra allowed the substances which passed into the bladder a tolerably free escape, and no calculus formed."

I attended, with Mr. Garrod, of Hackney, two years ago, a lady, in whom some fæces passed through the bladder and urethra, and who is still alive.

In a case which I visited with Mr. Rance, of the City Road, in 1831, and which terminated fatally, there was a communication between the fundus of the bladder and the colon, just above a stricture, which existed in the sigmoid flexure.

I am indebted to Mr. Rance for the following account of the case:—

CASE.

About the latter end of June, 1831, I was called to visit Mr. Henry Cooper. He complained of a deep-seated dull pain in the lower part of the abdomen, extending from the pubes to the sacro-iliac symphisis of the left side; he said that he had been affected with pain in the bowels for nearly twelve months; he complained of considerable uneasiness in the urethra, and a burning sensation towards the extremity of the penis. The urine was high coloured. On pressing the hypogastric region with firmness, he suffered considerable uneasiness; his tongue was dry, a little furred, and of a brownish hue; his pulse was quick, about 110, and rather firm. I bled him to the amount of about eight ounces; ordered a dozen

[1] Lectures on the Urinary Organs, p. 317.

leeches to the perinæum, and a blister to the lower part of the abdomen; and administered a purgative. On the following day, the pulse was softer, and the urine high coloured, with a very considerable deposit of a purulent kind, and the smell very fetid. I ordered liquor potassæ and extract of hyosciamus. On the following day, I found the urine contained a considerable quantity of feculent matter, which led me to conclude that there must be an ulceration of the intestines. Flatus was also passed through the urethra; stools voided per anum, were always loose; and he said that he had not passed a solid stool for a very considerable time. On examination per rectum, the finger could not reach any ulceration or stricture; no urine ever passed per rectum. The pain and uneasiness increased; and I confined myself, in the treatment, to the sedatives, and administered various forms of opium. The strength gradually decreased, and he sank in the latter end of August. I obtained permission to inspect the body, and found that a stricture had taken place in the sigmoid flexure of the colon; above the stricture, slight adhesion existed with the fundus of the bladder, towards the left side. There was a small opening through the stricture, about the size of a goose quill, through which the fæces passed into the rectum. From the narrowness of this passage, it was impossible that any solid fæces could pass. The portion of the intestines, for about two inches above the stricture, and part of the fundus of the bladder, appeared gangrenous, and in a state approaching to sloughing; the coats of the bladder were thickened, and the bladder itself was about the size of a large orange; and, from being so much thickened, it appeared incapable of further distension.

The more usual course of the disease is, that ulceration gradually extends to the whole of the membrane, which is destroyed, and then the muscular structure is shown better than any dissection can represent it. In the progress of the ulceration, disease commonly manifests itself in one of the kidneys; and, as far as my observation goes, usually in the left kidney. This is indicated by pain in the loins on pressure (for the pain is never very severe), by shiverings, sickness, and the albuminous state of the urine. At this stage, large quantities of pus are voided with the urine, and the urine is tinged with blood.

Attempts have been made to determine, by the qualities of the pus, whether it has been secreted from the bladder, or has passed from the kidney.

"When nearly pure," says Dr. Prout, "and unaccompanied by mucus, or when it contains blood, it may be supposed in general to be derived from an abscess. Most frequently, however, it is accompanied by mucus; indeed, mucus and pus are so nearly related as to run into each other imperceptibly; and when the mucus is in excess, and has preceded the pus, we may almost always conclude that some portion of the mucous membrane lining the urinary organs is the common source of both." I may observe, that when pus and mucus exist in small quantities in the urine, it is difficult

to distinguish one from the other. Pus, however, when well marked, may be distinguished from mucus by being composed of particles. Hence, when diffused through a fluid, the latter is rendered opaque, though, upon standing, the pus subsides to the bottom of the vessel, in a state more or less pulverulent, and the fluid assumes its transparent character, but it also mixes more readily with the urine. If in urine pus be present with mucus, it is found lying on the latter, and presents a much yellower tint; it is also quite opaque; whereas mucus is more or less transparent.

As to the morbid appearances, it is known that the inner membrane of the bladder is very seldom tinged with blood on its inner surface, in a natural state; but when it is inflamed, it appears covered with a multitude of delicate blood-vessels, which are sometimes intermingled with little spots of extravasated blood.

The inflammation of the inner membrane of the bladder extends itself either over the whole bladder, or else is limited to some particular part of it; most commonly that part which adjoins the neck of the bladder is found in a state of inflammation. The inner membrane is sometimes covered with coagulable lymph; this adventitious substance has been found projecting into the cavity of the bladder; and portions of it, during life, have been occasionally separated.

In Dr. Baillie's plate of ulceration of the mucous surface, the ulceration commenced from the fundus, and proceeded towards the neck. In a specimen which I have, where part of the membrane is only destroyed, it commenced at the neck.

If the inflammation has reached a high degree, the muscular structure is also attacked, presenting here and there gangrenous spots, or being completely destroyed by it. But, as the latter adheres but loosely to the inner membrane of the bladder, the inflammation does not easily pass from one to the other. One of the kidneys will usually be found in a state of ulceration, containing pus, and the ureter inflamed in its whole course, and at its vesical extremity ulcerated. In most of the cases which I have dissected, the whole of the membrane has been removed by ulceration. But sometimes round ulcerated spots, of the size of a sixpence, are found in different parts, with the elevated edges and a red surface, the muscular structure not being seen, and the remaining membrane being very vascular. The ulcers, when small, are not unlike primary syphilitic sores, by their excavated surfaces and raised margins.[1]

This affection may be confounded with inflammation of the muscular structure, but in the latter case there is not the power of passing the urine, and the desire to void it is less frequent, not being experienced until a good deal of urine is accumulated in the bladder, and then coming on in violent paroxysms. Neither is there the burning sensation along the urethra which is felt when the mucous membrane is affected.

[1] Cyclopædia of Practical Medicine, vol. i. article *Cystitis*, by Dr. Cumin.

This disease is very likely also to be mistaken for stone. The uneasiness in the bladder, the frequent desire to make water, and the passage of blood with the urine, are symptoms of stone as well as of this complaint. But in stone, the pain is principally experienced after the bladder has been emptied, whereas, in acute inflammation of the mucous membrane of the bladder, the pain is most intense when the bladder contains urine, and subsides when it is empty; in stone, larger quantities of blood are passed than in this disease, and the urethra is seldom so irritable.

If the disease of the bladder coexist, or be connected with organic mischief in the kidney, or any other organ, little or no good will be derived from medical treatment. But as I am speaking of idiopathic inflammation of the mucous membrane of the bladder, I will pass over cases occurring from such causes.

Blood should be taken at the commencement, by the application of leeches to the hypogastric region, and they should be repeated so long as the severity of the pain continues, and the strength of the patient will allow. Commonly, however, the loss of much blood cannot be borne. The most valuable remedy at the early stage is morphium or opium, (I prefer the former,) given in sufficient doses to allay the pain about the bladder and along the urethra, as well as the frequent desire to pass the urine. These are the most distressing of the whole class of symptoms; and if unmitigated, they soon wear out and exhaust the strength of the patient; but if only a few hours' intermission be obtained in the day, some chance may exist for the recovery of the patient.

In addition to the internal use of opium, or morphium, anodyne injections, or suppositories, should be exhibited at bed-time, and great relief will be experienced from their use. Some practitioners recommend the injection of oil and opium, and other remedies, into the bladder, by means of a gum elastic catheter; and in one of my patients this plan had been tried at the suggestion of an eminent physician, prior to the patient being placed under my care, but no benefit was derived from this treatment. In fact, the pain and irritation which are experienced from the introduction of any instrument along the urethra are so severe, as to deter me from employing this plan; and unless there be retention of urine, which is very rare in this form of disease, the use of the catheter, sounds, and bougies, should be particularly avoided.

It will be advantageous to employ counter irritation above the pubes; and the hip bath at night will be found very serviceable.

In the treatment of these cases, however, we find that no remedy, opium or morphium perhaps excepted, long retains any influence over this complaint. The practitioner must be armed with a variety of agents, so as to be able to substitute one for another, when it loses its effect. An infusion of diosma, in the proportion of an ounce to a pint of water, the decoction of wild carrot seeds and parsley breakstone, small doses of copaiba and essential oil of cubebs, infusion of hops and the alkalies, will, all in their turn, be found useful.

Mercury is not of use in this form of inflammation, excepting at its commencement.

The greatest attention should be paid to the diet of the patient. Animal food, wine, spirits, and acid drinks, should be interdicted; the diet should be light, consisting of bland, farinaceous food; and the drink, of water, toast and water, and linseed tea; but not to such an extent as to increase, in any very considerable degree, the secretion of urine. The patient should also be kept as quiet as possible, and in rather a warm temperature.

The prognosis of these cases is very unfavourable, if the ulcerative stage once set in, and this is usually indicated by the continuance of the pain of the bladder on motion, and in making water. If, therefore, the pain be not subdued early, little hope can be indulged of a successful termination to the case. By judicious management, life may be prolonged for some time, but the patients are seldom cured. Having witnessed several cases of this kind, most of which terminated fatally, I fear that the complaint is irremediable, if ulceration to any great extent exists; all we can then do is, by opium and other narcotics, administered internally, to endeavour to lessen the irritation and pain.

If a female, (and females are more subject to this complaint than males,) whilst labouring under the disease, happens to become pregnant, the occurrence of this state mitigates very much the symptoms, and averts for a time the fatal determination. In 1827, I examined the body of a French woman, who immediately after her delivery was attacked with all the symptoms I have mentioned above, and died within a week from the attack. On examination, the whole inner membrane of the bladder was found completely destroyed. I could not obtain any accurate account of the case; but I learnt that the patient, for the few days she was in the hospital prior to her delivery, did not complain of the affection of her bladder. One case, however, I watched from the commencement of the disease (which occurred a month after marriage) to the death of the patient, which took place a month after delivery; and during the latter half of her pregnancy, her symptoms were much milder than before, but soon after the child was born, they returned with their accustomed severity, and destroyed the person.

CASE—DESTRUCTION OF THE MUCOUS COAT OF THE BLADDER.

I was requested, on the 17th of May, 1834, to visit Mrs. M., æt. 36, who was supposed to be labouring under symptoms of stone. She had frequent desire to make water, attended by darting shooting pains in the region of the bladder, which were much increased by walking, or exercise of any kind. The urine itself was acid, and contained some shreds of lymph or mucus. No blood or gravel had ever been passed. I sounded the patient, and the instant the instrument was introduced into the urethra, the pain experienced was most intense, and this continued during the whole of the examination. No stone could be felt. The pulse was

small and quick, skin dry and rough, tongue white, countenance anxious, and indicative of much suffering. I expressed from the first a very unfavourable opinion of the case, believing, as I stated, there was ulceration of the bladder. She had been in this state for two months, and various remedies had been tried. I suggested the use of the pareira brava, first in the form of an infusion, then of decoction. For the first six weeks, leeches were occasionally applied to the hypogastric region, and tartar emetic ointment rubbed in, and at night, a thin starch injection, with twenty minims of Battley's sedative solution, was given. After this time, Mrs. M. simply tried the decoction of pareira brava, till about two months prior to her decease, when, perceiving more mucus in the urine than usual, and occasionally blood, I added a very small quantity of balsam of copaiba to the mixture (two drams to eight ounces of the decoction, with some mucilage). This brought on sickness, and deranged the stomach so much, that she was obliged, from this time, to desist from taking the decoction. She now had sickness and nausea; pus was voided with the urine; there was complete loss of strength, emaciation of the body, hectic flushes, and on the 24th of November, death put an end to her sufferings. It should be observed that, for a few days prior to her death, no pus had been voided with the urine, and the pain and frequent desire to make water, for the only time during her long illness, almost left her.

The body was examined within forty-eight hours after death, by Mr. Merriman, jun., of Kensington, and myself. The bladder was not thickened or contracted, but so completely divested of its mucous membrane, that not a single vestige of this coat could be seen. No dissection could represent the arrangement of the muscular structure so well as it was seen in this case. One spot, of the size of a shilling, towards the fundus, was black, and almost gangrenous. The ulceration had not extended to the urethra, but its lining membrane was highly inflamed. The right kidney was natural, but there was ulceration of the left, and its interior was filled with pus. The renal extremity of the left ureter was blocked up by a detached portion of the substance of the kidney.

CASE OF ULCERATION OF THE BLADDER, URETER, AND KIDNEY.

Deborah Mulloday, aged 46, was admitted under my care at the General Dispensary, for an affection of the bladder. She complained of great uneasiness, and sometimes pain, in the lower part of the belly, and frequent desire to void urine. After the bladder was emptied, the pain and uneasiness usually subsided. These symptoms were at first relieved by the use of the decoction of the pareira brava; the pain was at times very acute; the desire to make water became more frequent; the urine contained a good deal of pus; and on two or three occasions it was tinged with blood. The pulse was small and quick; the countenance pale and sallow; and there was emaciation of the body, with occasional shiverings and cramps. She had no pains in the loins; and there

was no sickness until about ten days prior to her death, when it was very distressing, and continued for some days. On Friday, July 26, she was seized with paralysis, and she expired on the following Tuesday.

The body was examined twenty-four hours after death. The mucous membrane of the bladder was ulcerated in several spots, but was not so much destroyed as in the preceding case. The bladder was thickened and contracted, and contained a good deal of pus. The vesical extremity of the left ureter was ulcerated; the pelvis of the left kidney was full of pus; and the substance of the left kidney in some parts completely destroyed by ulceration. The right kidney was in a state of atrophy, and its interior contained a deposition of chalky matter. The urethra was inflamed, but not ulcerated.

CASES OF ACUTE INFLAMMATION OF THE MUCOUS COAT, WITHOUT ULCERATION.

I. Mary Boyer, aged 17, of a good constitution, applied to me, October 26, 1833, for an affection of the bladder. She said that about six years ago, three years before the catamenia appeared, she felt a frequent desire and uneasiness in making water, accompanied with darting pain in the passage. These symptoms had continued, but latterly had been very much aggravated. The desire to make water came on every half hour, attended with great pain, which went off on the bladder being emptied. There was pain within the labia, and sickness. The urine was very acid, containing a good deal of albumen. The countenance was pale and anxious. The alkalies, the decoction of the pareira brava, the infusion of diosma, were tried in succession, and for a long time, without any relief. Great pains were taken by the parents to second my efforts, by attending to the diet, and keeping the patient as quiet as possible, and in a warm temperature; but for several months, little or no benefit was derived. During the whole of the time, the morphium was used, the dose being occasionally increased. At last, however, the pain began to subside, and from that time a favourable change occurred in her state. Her appetite and strength returned; the urine was less acid, and not tinged with blood; but the frequent desire to pass it still remained. She married a short time ago; and, with the exception of the frequent desire to make water, is now quite well.

II. John Leburn, aged 40, cook, applied to me, 17th March, 1834, for an affection of his bladder. He said that about four or five years ago he first felt a frequent desire to make water, particularly after drinking, or exertion, and that this symptom had increased within the last twelve months, to so great a degree, as to occasion him to void the urine almost every half hour, and the desire to make water was attended with a burning sensation in the passage. There was pain in the loins, particularly in the region of the left kidney, on pressure, a tickling sensation in the course of the left

ureter, uneasiness in the left testicle, pain at the glans penis, and occasionally sickness of a morning. The urine was acid, and contained a considerable quantity of albumen. His appetite was good, and his strength was not much impaired, but he has lost a good deal of flesh. There was no stricture or stone. The same treatment was pursued in this case as in the former; but for more than ten months he experienced no benefit. At that time he began to improve; and he is now pretty well, though he is not able to dispense with the morphium at night. In this case, the left kidney was no doubt considerably affected as well as the bladder.

III. Mrs. R., æt. 28, residing in Aldersgate street, of a delicate constitution, and born of gouty and rheumatic parents, consulted me in January, 1835, for an affection of the bladder. She said that soon after her first confinement, which took place in October, 1834, she could not pass her urine, on which account it became necessary to use the catheter; this was done eight or nine times, and the operation was attended with great pain and difficulty. From this period, a frequent desire to pass her water came on, which was accompanied with considerable suffering; this, however, subsided on the bladder being emptied. The urine was acid and albuminous, and contained some fine shreds of lymph. There was pain in the left kidney and over the region of the bladder, which was increased by pressure and motion of the body. There was pain in all the limbs, and down the inside of the thighs. The pulse was quick and small; the tongue very red; the countenance pale and anxious; the bowels costive. There was a great deal of leucorrhœal discharge. I ordered morphium, together with the infusion of diosma, and the lavement to be used when the state of the bowels required it. I should observe that, previous to my seeing this patient, a variety of remedies had been tried, but most benefit had been derived from small doses of copaiba, in conjunction with carbonate of magnesia, made into the form of pills. A month elapsed before any material amendment took place. As soon as the pain in making water had subsided, I gave the acetous extract of colchicum at bed-time, the alkalies after meals, and the decoction of pareira brava internally. To my great surprise, this lady recovered so as to be able to take a journey of some distance, and is now well.

CHAPTER IV.

SUBACUTE INFLAMMATION OF THE MUCOUS MEMBRANE OF THE BLADDER.

Men are more subject to this complaint than females, and elderly persons than young ones. In some countries the disease is so uncommon, that Hoffman calls it *morbus rarissimus*. In others, it

appears more frequently, and something like it has been known to assume an epidemic character.

The discharge of mucus is the characteristic feature of the complaint; and hence the term *vesical catarrh*. This is accompanied by a sensation of heat in the bladder, extending along the urethra, weight in the perinæum, shooting pains towards the anus, and a frequent desire to void the urine, although not to so great a degree as in the acute form.

Sometimes the symptoms are very mild, and cause but little inconvenience; at other times, the disease assumes a serious character and even proves fatal, particularly in old and weak persons. Then the heat in the bladder and urethra are converted to a scalding; and the desire to make water becomes more frequent, is attended with violent straining efforts to void it, and retention often takes place, being usually caused by clots of mucus blocking up the passage. On the urine being drawn off, the symptoms are relieved for a time, but return on the filling of the bladder.

The patient is very restless and uneasy; there is great thirst; the bowels are irregular, generally very costive or relaxed; there is pain round the anus and in the region of the loins; great prostration of strength and wasting of flesh; and the patient at last dies completely exhausted.

The quantity of mucus secreted[1] varies: sometimes it is small; at other times it is considerable; and instances are recorded, where several pounds were passed in the twenty-four hours.

Small quantities of the mucus thus coming away, render the urine muddy, pale, and flaky, and afterwards settles to the bottom of the vessel.

The mucus,[2] however, is sometimes like panada, and on being shaken, colours the urine without flakes, and at other times it is stringy and flaky, and of a lumpy nature. It has been seen so glutinous, that on pouring it out of one vessel into another, it drew itself out above a foot in length without rending. Sometimes it is transparent, white, yellow, green, with streaks of blue, often without smell; sometimes, on the contrary, dreadfully fetid.

When the properties of the mucus are but little changed, it diffuses itself throughout the urine for a time, and renders the urine turbid, and of a whitish colour, but afterwards subsides to the bottom, and leaves the urine to assume its usual colour. But it is commonly thick, viscid and ropy, and sinks to the bottom of the vessel at once: in this case the urine is of a dark brown colour, and is either neutral

[1] Mucus always exists in healthy urine in minute quantities; and it may be procured by throwing the urine on a filter immediately after being evacuated, when it may be collected in transparent colourless flocculi, which if allowed to dry on the filter, possess a shining appearance.

Mucus is not coagulated by boiling, which sufficiently distinguishes it from albuminous matter. It is soluble in the acetic and nitric acids; but sulphuric acid does not dissolve it. It is soluble in caustic potass. *Vide Rees on the Blood and Urine.*

[2] Vid. Soemmering über die Krankheiten der Harnblase, &c.

or alkalescent. The urine, however, is usually acid at the commencement, and continues so until the quantity of mucus secreted is great: in this case especially, if the patients are very feeble, the urine is alkaline or neutral.

If this mucus comes away in large quantities, and is glutinous, it requires an effort to discharge it, and often occasions retention. After the voiding of it, the burning sensation in the region of the bladder ceases, but gradually returns as the mucus again collects.

In slight cases, the mucous membrane is inflamed, and presents here and there red spots, as if blood had been effused beneath the surface, while some are seen of a darker colour, almost amounting to black. Sometimes it is abraded, particularly around the darkest patches; and, in some rare cases, it has been entirely removed so as to leave the muscular fibres exposed.

If the secretion be copious, the patient becomes hectic, and at last sinks from exhaustion.

In the severe form of the disease, the whole of the muscular fibres of the bladder are much enlarged, thickened, and occasionally covered here and there with calcareous deposits. I have in my possession, the bladder taken from a man who had long suffered from vesical catarrh, presenting this appearance. In some cases of stone, an abscess is formed in the thickened coats of the bladder, and the mucous membrane is found in a gangrenous state. The kidneys, too, generally suffer: either they are simply inflamed, with the infundibula and pelvis much enlarged, or they are in a state of ulceration. The ureters are also inflamed.

The exciting causes of the catarrh of bladder are, stone, enlargement of the prostate, exposure to cold, indulgence in ardent spirits, diuretic and irritating remedies, such as cantharides, violent exercise on horseback, venereal excesses; and it exists in connection with hemorrhoids, and other diseases of the rectum. In some of the injuries and diseases of the spine, this state of the bladder frequently occurs.

Soemmering lays great stress on suppressed gout as the cause of the complaint; and Dr. Prout says, "Most frequently it attacks the gouty; and the worst case I ever witnessed occurred in a gentleman, who, for many years, had been a martyr to gout, and in whom it succeeded to an acute seizure in the bladder, that took place during an attack of that affection." There are some habits apparently more predisposed to this affection than others; such are those of an irritable scrofulous temperament, with fair skin, and tendency to cutaneous affections, more especially if they have been accustomed to live freely, or been given to venereal excesses, or have suffered from venereal affections, or gout. In such individuals exposure to cold seems one of the most frequent causes of this affection, and those who actually labour under it are generally found to suffer much more severely in cold weather.

Cases of a milder character have been observed to terminate in a short time, or to assume an intermittent form, especially when

associated with hemorrhoids, or certain petechial affections. Old persons mostly retain the complaint as long as they live.

If there be stone in the bladder, all efforts at cure, till the stone be destroyed or removed, will be ineffectual. The severity of the symptoms will depend on the composition and size of the stone, and the constitution of the patient; and, if an operation be not consented to, these circumstances must guide the surgeon in the selection of the palliatives he may employ.

The use of the catheter, even if there be no retention, must occasionally be resorted to; but in severe cases, retention generally exists, and the water should be drawn off twice in the twenty-four hours.

Injecting the bladder in particular states of this disease will be highly serviceable. Sir B. Brodie says, "that in aggravated cases of the disease, where the symptoms are at their greatest height, the mildest injections, even those of tepid water, will do harm rather than good. They are especially to be avoided when the mucus deposited by the urine is highly tinged with blood. When, however, the symptoms have in some degree abated, the injection of tepid water, or decoction of poppies, is in many instances productive of excellent effects. An elastic gum catheter may be introduced into the bladder, and the injection may be made by means of a small elastic gum syringe. The liquid should be allowed to remain in the bladder about thirty or forty seconds, and not more than an ounce and a half or two ounces should be injected each time. If the bladder be distended, so as to occasion any considerable degree of pain, the effect is always injurious instead of being beneficial. This operation may be repeated according to circumstances, once or twice in twenty-four hours. When there is a further abatement of the symptoms, the disease having assumed a still more chronic form, and the mucus being free, except on extraordinary occasions, from all admixture of blood, we may venture to add to the injection a very small quantity of nitric acid. At first, the proportion ought not to be more than that of one minim of the concentrated, or ten minims of the diluted nitric acid, to two ounces of distilled water; but afterwards this proportion may be doubled."

The tenacious mucus, which belongs to this state of the bladder, deposits phosphate of lime; and when phosphate of lime from this source co-exists, as often happens, with the triple phosphate in the urine, a combined salt is formed, and in these cases a weak solution of nitric acid (beginning with a drop, gradually increased to two of concentrated nitric acid to two ounces of distilled water) injected into the bladder, acts as a salutary astringent.

The medicines which will be found most serviceable when there is much secretion of mucus, are the decoction of the uva ursi, with the muriated tincture of iron, and small doses of powdered galls and nitre. The decoction of the pareira brava is an excellent medicine, if there be much pain and irritability of the bladder; and it may be combined with the nitric acid to lessen the secretion of mucus. If there be much pain and restlessness, morphium or

opium ought on no account to be omitted to be given. Barthez mentions a case where fifteen pounds of mucus were passed in thirty-six hours, and was cured solely by the exhibition of large doses of opium internally, and in the form of clysters.

If there be any tendency to gout in the constitution, colchicum should be administered; the form in which I am in the habit of giving it, is the acetous extract of colchicum in the dose of one or two grains at bed time. Small doses of copaiba, or the essential oil of cubebs, with hyoscyamus, will often do great good in these cases, and may be added to the decoction of the pareira brava, or given alone. But both cubebs and copaiva must be administered with considerable care, for chronic inflammation of the bladder sometimes comes on after the long continued use of these medicines. I need not say that blood-letting is never required in this complaint. In the severer form, where there is great depression of the vital powers, the patient should be sustained with light nourishment, and small quantities of wine from time to time. In the milder form, the patients may be allowed to take animal food; but beer, wine, and spirits must be strictly prohibited. The patients must also be cautioned against exposure to cold, and irregularities of every kind, and told the consequence of neglecting the advice given them. From want of care on the patient's part, the mild has often assumed the severe form, and an attack of acute inflammation has come on, and destroyed life.

CASE.

In December, 1833, I attended with Mr. Holmes, of the Kingsland Road, Mr. T., æt. 80, who, for some time past, had been subject to occasional difficulty in passing his urine, and to the discharge of mucus, which latterly had very much increased. When I saw him, there was a frequent desire to pass urine, attended with great pain and uneasiness in the lower part of the abdomen, sense of burning in the urethra, and inability to pass it, cramps in the legs, thirst, and slight shivering. On drawing off the water, these symptoms subsided for a time, but invariably returned on the filling of the bladder. The urine was acid, of a dark brown colour, and contained a great quantity of mucus more of an amber colour than any other. This always subsided to the bottom of the vessel, was very tenacious on being everted, and could be drawn into long ropes. Sometimes the mucus would come out in clots, and was occasionally very offensive to the smell, and streaked with blood. On exposing some of the mucus to the action of cold for a few hours, it became quite dense. Morphium, the decoction of the uva ursi, with the ammoniated tincture of iron, the decoction of the pareira brava, lavements, and the regular introduction of the catheter, were employed, but without any avail; his strength gradually declined; and the patient sank at the end of six weeks. There was no post mortem examination.

CASE.

The following interesting case occurred in the practice of my friend, Dr. Elliotson.

The individual had laboured under cystorrhœa, as it is sometimes called, or a discharge of mucus from the urinary bladder, for a great number of years. A large quantity of mucus was constantly deposited in the vessel which he used; and that it was the true mucus was evident, from its capability of being drawn out into long threads. He went on in this way for a number of years, and various remedies were used, but they were all rendered useless, I am quite satisfied, from his not listening to good advice, but taking an excessive degree of exercise. Any remedy, however, that was at all irritating, did him a great deal of harm: mild means only were suited to him. I am not sure that even these did him any good; but at any rate they did him no harm. The consequence of thus not taking care of himself, and taking considerable exercise, was, that what at first was a mere excessive secretion of the bladder, became at last organic disease of the organ, slow inflammation, hypertrophy, and finally, pretty active inflammation.

"Here," says Dr. E. "is the bladder amazingly thickened: its substance seems in a high state of hypertrophy. You see that the muscular fibres are considerably increased, and that canals have been formed. Here is the verumontanum; here the prostate; and here a very considerable hypertrophy of the muscular coat, mucous membrane, &c., at the part corresponding with the trigone vesicale; so that a large tranverse fold and pouch are formed by it. This person had from three hundred to four hundred small stones in the gall bladder, but he never suffered any inconvenience from them, and their presence was unexpected: you will rarely see an urinary bladder thicker than this. He had no stone, no stricture, no difficulty in passing water, but an excessive gleet, if I may say so, from the interior of the bladder for many years. We could almost fancy, from its rugousness, that the interior of the bladder was the interior of the stomach. The symptoms at last were great pain, extreme agony indeed, a constant desire to make water, a discharge of blood as well as of mucus, which at last was rather pus than mucus. From excessive secretion, there came on chronic inflammation of the substance of the bladder; and at last that chronic inflammation became acute, and destroyed the patient."

CHAPTER V.

ACUTE INFLAMMATION OF THE MUSCULAR STRUCTURE OF THE BLADDER.

Some authors conceive that the muscular structure of the bladder is never inflamed alone, but that the peritoneal and mucous membrane partake at the same time of the inflammatory action. Mr. Howship[1] says, "an acute inflammatory action of the bladder is, I believe, never confined entirely to the muscular coat. Either the mucous membrane within, or the peritoneal covering without, or both, have been always, as far as I have seen, more or less involved in the same state, and consequently the phenomena of irritation become blended with the symptoms of inflammation." Boyer, on the other hand, says, "Inflammation of the bladder, like that of all organs, composed of several tunics and lined by a mucous membrane, may attack all the tunics at once, or only the internal coat. The first case is termed inflammation of the bladder or cystitis, the second catarrhal inflammation, or catarrh of the bladder. At all events, it is right to observe, that, in cystitis, the mucous membrane partakes, more or less, of the inflammation ; and that, in acute and very intense catarrh of the bladder, the other membranes of the viscera are also inflamed. Hence, without doubt, the difficulty in several cases of distinguishing the symptoms of inflammation of the mucous membrane, from those which belong to the inflamed state of the other membranes." Mr. Wilson, in his lectures on the urinary organs, says, "Inflammation may arise from various causes, affecting the whole of the coats ; or it may arise from a cause acting only on one, and may be confined to that single coat." And in this opinion I entirely concur.

With the exception of those inflammations of the bladder, which are caused either by stone or the operation of lithotomy, or else proceed from outward violence or wounds, idiopathic acute inflammation of the muscular membrane of the bladder, is, I admit, comparatively rare; whilst, on the contrary, affections of the mucous membrane of the bladder, and even chronic affections of the muscular tissue, are more frequently met with. Hence we find, that there are few cases of it noticed by the surgeons of the last century, Vogel even says, "Nulla fere fit hujus morbi a recentioribus auctoribus mentio." It more frequently attacks adults than the young or old, and strong robust persons than those who are delicate. It is, also, more common in males than females, whilst the contrary is the case in regard to the acute inflammation of the mucous membrane.

The patient first complains of a dull aching pain in the region of the bladder, which soon becomes more violent and extends itself to the neighbouring organs. This pain is increased by pressure, and is attended by a desire to pass the urine, without, however, the

[1] On the Secretion and Excretion of Urine, p. 230.

power to satisfy it. The desire is not incessant, but comes on in paroxysms, attended with pain. The urine is evacuated at first in small quantities, and the attempts to pass it cause great pain. The small quantity which escapes is of a dark colour, sometimes not unlike coffee in appearance, at other times of a deep red, and even bloody colour, and at last complete retention occurs.

There is a sense of fulness in the lower part of the abdomen, pains in the lumbar region, in the groins, and down the thighs, but there is not the burning sensation along the urethra, and in the perinæum which is found in the inflammation of the mucous membrane. The complaint is ushered in by rigors, which are soon succeeded by great constitutional disturbance. The pulse is full and hard, the thirst is great, and the skin hot, with general uneasiness and sickness. If the inflammation increases, pains are felt in the intestines, particularly in the rectum, combined with tenesmus, delirium comes on, the pulse rapidly sinks, and the patient soon dies. If the inflammation be seated, as is frequently the case, in the neck of the bladder, the urine which has entered the bladder is retained by the inflammatory action in that part, and the bladder soon becomes distended and projects above the pubes. There is a sense of weight in the perinæum, and often painful erections of the penis, and an examination by the rectum gives great pain.

The anatomical arrangement of this part easily accounts for these symptoms. The triangular space is at once very vascular and highly sensitive: its nerves arising from the third and fourth sacral pairs, as well as from the great sympathetic, descend on each side through the inferior mesenteric and the hypogastric plexus, and communicate more particularly on this space. When irritated, therefore, it gives rise to the desire to evacuate the bladder, and to great pain in states of disease.[1]

If the inflammation is situated somewhat higher up in the bladder, where the ureters enter, the orifices of the latter will be contracted, and the ureters themselves enormously enlarged. If the inflammation extends to both the orifices of the ureters, the bladder is closed against the influx of the urine, and the ureters become enormously distended. I examined, with Mr. Camplin, the body of a young gentleman who died of this complaint, in whom the ureter was so distended, as to equal in size a portion of the small intestines.

[1] With regard to the urethral opening of the bladder, Mr. Guthrie observes, "that fibres have been described surrounding this part, though no anatomist has demonstrated them so as to warrant their being called a sphincter muscle; that this part may be both muscular and elastic, but that the older anatomists supposed the power which prevented the flow of urine to reside in other muscles surrounding the membranous part of the urethra; that he is able to show and to describe these muscles; that the fact of there being an elastic structure at the part is of great importance, because it enables us to account for the occurrence of certain diseases, in a more satisfactory manner than formerly, to take new views even of these diseases, and to adopt new modes of practice, which may be found more beneficial."—*On the Diseases of the Bladder, &c.*

The orifices of the ureters[1] are surrounded by a dense elastic substance, which lies between the muscular and the mucous coats of the bladder: beginning at the base of the triangular space, it inclines inwards as it advances towards the neck, forming in a great measure the orifice, and appearing to be continued through the urethral passage as its elastic membrane. This elastic triangular substance yields to a certain extent to the pressure of the urine, when impelled by the detrusor urinæ, and returns to its original situation when the pressure is removed.

If the inflammation is situated more in the upper part of the bladder, there is danger of its extension to the peritoneum, and pain is greater on pressure; but the desire to pass the urine is not so frequent and the difficulty less.

The progress of the complaint depends on the severity of the symptoms. Very severe cases occurring, for instance, after suppressed gout, sometimes terminate fatally within a short time of the commencement of the attack; but, in ordinary cases, after two or three days, if active measures be employed, the pain begins to subside, the water flows with greater facility, is less acid, and of a lighter colour. The febrile symptoms, and, at the same time, the local uneasiness, lessen. This form of inflammation sometimes terminates in the formation of abscesses in the coats of the bladder, and the symptoms are of a very formidable character, depending upon the size and situation of the abscess. The urgent symptoms of the inflammation subside; but there is a dull pain in the region of the bladder, occasional rigors, with febrile excitement, and uneasiness in passing the urine and the fæces. The abscess may open into the cavity of the bladder, in which case the pus is evacuated with the urine, and the patient experiences great relief; or, on the other hand, the matter may extend into the cellular tissue of the pelvis, and make its way either through the rectum, or to the perinæum, or even to the groins, in which cases the result is most frequently fatal. Mr. Wilson mentions an interesting case, where extensive suppurations had taken place in the coats from the prostate to the fundus of the bladder, the matter being lodged every where between the coats, and near the fundus several ulcerations had taken place through the internal membrane, by which the matter had passed into the cavity of the bladder.

This complaint may be easily mistaken for acute inflammation of the prostate gland; the uneasiness and pain in the region of the bladder and the perinæum, the occasional but strong desire to pass urine, every effort being attended with great pain and retention, are symptoms common to both complaints. In inflammation of the prostate, however, there is more fulness and tenderness on pressure in the perinæum, and on examination, per rectum, the prostate will be found exceedingly painful and sensitive.

The morbid appearances which are found in acute inflammation of the muscular coat of the bladder, are, in recent cases, great vas-

[1] Guthrie, op. cit. p. 5.

cularity, the tunic being thoroughly injected with blood, and of a dark red colour.

Sometimes this coat will be found even to be gangrenous, and instances are recorded where it has given way, and the urine escaped into the pelvis. The mucous membrane will be also found of a dark red colour. In other cases, the membrane will be found thickened, and the bladder itself contracted. Pus is found sometimes infiltrated through the tunic, or else circumscribed in the form of an abscess.

Acute inflammation of the bladder is sometimes caused by exposure to cold, and indulgence in spirituous liquors, but more frequently it occurs in gonorrhœa, on a sudden suppression of the discharge, when the metastasis takes place to the bladder.

Amongst its causes may be also classed wounds and blows, or injuries from the incautious or violent use of instruments. The immoderate use of cantharides internally, will produce this complaint, and even in excitable persons the external application of this medicine. After an irregular or suppressed attack of gout, this affection comes on, and frequently assumes a very serious and formidable character.

CASE.

Richard Serigiter, æt. 68, watch-maker, after a slight attack of gout, was seized with rigors, which were succeeded by fever and great constitutional irritation. His pulse was extremely quick; the skin was hot and dry; and there were great thirst and sickness. He had a strong desire to pass the urine, which came on in paroxysms, but he could pass but a few drops at a time. There was pain in the region of the bladder and loins. Colchicum, and the saline aperients, were administered; leeches and warm fomentations applied to the region of the bladder; and the warm bath tried. The bladder being distended, a catheter was introduced, and between two and three pints of very dark urine was drawn off. None of these measures gave any relief: the constitutional disturbance increased, delirium came on, and the man died within forty-eight hours of the commencement of the attack. I examined the body on the day after the decease, and found the bladder in an intense state of inflammation: there was no organic change in its structure, but the tunics, particularly the muscular coat, were of a very deep and red colour. I have the preparation in my possession, and although it has been in spirit three or four years, it still retains its redness.

The symptoms of this complaint are so severe, and its progress so rapid, that prompt and decisive measures must be adopted. General blood-letting, if the patient be strong or robust, must be first employed; or, if the patient be delicate, and of a spare habit, local bleeding, as leeches to the pubes, or cupping in the perinæum, may be substituted; or these may be regarded as auxiliaries to the general blood-letting.

Hot fomentations should be constantly applied to the pubes, and the patient, after the bleeding, should be placed in a hot bath. As I have already observed in these cases, there is retention, and the urine must be from time to time drawn off by the catheter. Internally our main reliance must be placed on the use of calomel and opium, which must be given every three or four hours: this medicine affords the most speedy relief. As there is frequently tenesmus, the proportion of opium should be large, and at the same time sedative injections should be administered. After the urgency of the symptoms have subsided, the saline aperients, combined with the vin. semin. colch., will be found beneficial, especially if the attack has occurred in a gouty subject. The diet must consist of nothing but lukewarm mucilaginous drinks. If the complaint has arisen from the suppression of the discharge in gonorrhœa, it subsides on the reappearance of the discharge.

If these means be employed early, the patient soon experiences a diminution of the pain. The water is passed in greater quantities and with less suffering, his constitutional symptoms improve, and he then falls into a sound and refreshing sleep. If, on the other hand, these measures be delayed, the symptoms which have been before described become aggravated, and delirium and death ensue.

CHAPTER VI.

CHRONIC INFLAMMATION OF THE MUSCULAR COAT OF THE BLADDER.

It not unfrequently happens that, after an acute attack, the bladder never recovers its usual tone, and the chronic form of the complaint supervenes: at other times, it is an idiopathic affection, the acute form never having preceded it. The complaint is extremely distressing, and I regret to say, seldom cured.

In this affection, there is uneasiness about the region of the bladder, frequent desire to make water, both by night and day, but especially by night, and the urine does not flow so readily as it did: there is also uneasiness about the region of the bladder, and occasional prolapsus of the rectum. The patient frequently complains of pains in all the limbs and in the region of the back; the skin is dry, and attacked with psoriasis or lepra; the urine is scanty, of deep colour, and of high specific gravity. The kidneys, after a time, are involved in the progress of the disease, the urine becomes albuminous, nausea supervenes, the patient loses flesh and strength, and sinks at last from complete exhaustion.

In this case, the coats of the bladder become thick and hard, so that they no longer admit of the former degree of extension. When this is the case, the patient experiences in the pelvis a sense of weight, and the bladder may be felt through the rectum, as a hard

thick body. "The elasticity of the neck of the bladder," says Mr. Guthrie, "is impaired, it will not dilate with the ordinary action of the detrusor muscle, and this is therefore augmented. A sensibly increased delay is experienced before the water begins to flow, and the patient is conscious of the augmented effort made by the bladder; in other words, he is obliged to strain to expel it. The desire in which this originates soon amounts to uneasiness, and rapidly afterwards to pain, relieved on evacuating a little water; but too soon to return; for the bladder is now never completely emptied, and the urine which remains is a source of great irritation, although the quantity is really inconsiderable."

On dissection, the bladder will be found more or less thickened; and its inner surface presents a considerable number of rugæ, caused by the projection of the enlarged fasciculi beneath. The thickness of the bladder is sometimes very considerable. Dr. Baillie has given the representation of a bladder nearly an inch in thickness: the prostate gland is enlarged.

The muscular coat of the bladder, when called upon, or excited to repeated and forcible action, through stricture of the urethra, or prostatic enlargement, or calculus, becomes firmer, thicker, and of a darker colour: it sometimes attains a thickness exceeding half an inch. In this state it does not dilate as before, and is incapable of holding more than a few ounces of urine. In fact, as Dr. Cumin justly observes, in all prolonged diseases of the urinary bladder, when frequent ineffectual attempts are made to evacuate its contents, the muscular coat acquires an extraordinary increase of size and firmness, separating into distinct bundles, which project on its internal surface, and leave spaces through which the mucous membrane is forced, thus forming small pouches: this is not the consequence of inflammation, but of increased muscular action.

This disease is frequently the sequel of acute inflammation, but is also caused by strictures in the urethra, enlargement of the prostate, prostatic calculi, cold, stone, indulgence in spirituous liquors, irritating medicines, as cantharides; and in some constitutions the long-continued use of cubebs and copaiba. In persons in whom there is an hereditary predisposition to urinary affections, it occurs from slight causes, as well as in gouty and rheumatic subjects. The retention of the urine in the bladder, after the desire to void it has been felt, often brings on this complaint.

This affection is likely to be confounded with simple irritation of the bladder; but the absence of pain, and of the constitutional symptoms which I have described, is the great diagnostic sign. Hysterical females are also subject to a peculiar form of irritation of the bladder, which might be mistaken for inflammation. They suffer great pain, and even have retention of urine; but the temperament or constitution of the patient will show the nature of the disease.

When this affection is produced by stricture, or any local cause, it is clear that the primary affection should especially engage our

attention, but even when this has been removed, the inflammatory complaint of the bladder often remains. In gouty, rheumatic, or plethoric persons, colchicum given at night, in the dose of one or two grains of the acetous extract, will be found of great service; and as in these cases the urine is acid and often scanty, the alkalies should be given. I usually advise them to be given after meals, and I employ a formula, which Dr. Prout often uses, viz. the bicarbonate of potass, sesquicarbonate of soda, and nitrate of potass. In addition to these medicines great benefit will be derived from the pareira brava. Some years ago, I published some cases of this complaint, which were relieved by this remedy, and subsequent experience has quite confirmed the opinion which I then ventured to express of it. This medicine formerly had a place in the pharmacopœia; and after being omitted for a time, it is restored to the edition which has recently appeared. It was very much in repute in many parts of Europe in the beginning of the last century, and in a work published at that period by Andreas Helvetius, it is mentioned as a specific for the affections of the bladder and kidney: his observations are,—"La racine de pareira brava est un specifique contre toutes les maladies des reins et de la vessie qui sont curables. Il agit avec tant de douceur qu'il n'y a point d'occasion où l'on ne puisse l'employer sans en craindre de mauvaises suites, et on peut comparer ses effects aux specifiques du quinquina, de l'hypecacuanha," &c.—*Traité des Maladies les plus frequentes, &c., par M. Helvetius, Liege*, 1711.

The mode of preparing this medicine, as advised in the present pharmacopœia, is to put six drams of the root into a pint of water, and to macerate it for two hours. I usually, however, order a decoction—an ounce to a pint and a half of water, to be boiled to a pint.

Messrs. W. Allen & Co., of Plough Court, have recently made some experiments for me as to the advantage of macerating the root previous to the boiling.

Three decoctions of the radix pareira brava were prepared with the following differences:—

1. Without previous maceration in cold water.
2. With previous maceration of 4 hours.
3. Ditto 12 hours.

On comparison, there appear but slight variations in the results. No. 3, however, seems to possess *rather a stronger taste* than No. 1. Perhaps the same may be said (in a less degree) of No. 2.

These decoctions are filtered with difficulty; but, by long standing, the feculent matter was separated, and the supernatant portions compared together. No. 1 was perfectly bright, while Nos. 2 and 3 were not quite so; yet, contrary to expectation, No. 1 was found to be of a rather greater specific gravity. This would imply that the previous cold maceration *does extract something, not permanently to remain in solution, but to be precipitated, and with it to carry down some other matter during the subsequent boiling.* If this be the case, it indicates the impropriety of the feculent part

being separated—at least until it is ascertained to possess no medicinal efficacy.

The extract of the pareira brava is also a very good medicine, and may be given in doses of ten grains, three times a day.

The diosma, in the form of an infusion, combined with the alkalies and tincture of hyoscyamus, will be found of great service. Should the urine not be acid, or, as is not unfrequently the case, should the alkalies produce headache and restlessness, or uneasiness about the region of the stomach, then their use must be discontinued, and resource had only to sedatives, as the extract of hop and extract of uva ursi, or the nitric ether, with the tinctura camp. co.; and the occasional exhibitions of suppositories. The diet should be plain, but nutritious, and all beer, wine, and spirits, should be prohibited. Exposure to wet and cold invariably aggravate this complaint, and should, of course, be avoided.

CASE.

—— Lind, æt. 68, of a gouty and rheumatic diathesis, a regular habit, (a patient of the General Dispensary,) says, that four months ago, whilst traveling to Birmingham, he felt a desire to make water, which, from the hurry of the coach, he was unable to get an opportunity of satisfying, and the consequence was, that at the end of the journey he was seized with retention. After this, his present attack came on, viz., pain in the region of the pelvis, scalding sensation in the passage, pain round the anus, diarrhœa, loss of flesh, great thirst, chilliness, tongue dry, constant desire to make water, with occasional incontinence: he is easy when the urine is passed. Has had a great deal of sickness. The urine when first passed is turbid, and of a whitish flocculent appearance: on being allowed to remain, the urine became clear, and of a bright straw colour; and some semi-fluid matter was deposited at the bottom of the vessel. There have been occasional streaks of blood in the urine for several years: there has been a difficulty in passing his water, or rather the stream has been small, and he has been longer passing it than he used to be. On examination per anum, the prostate is enlarged. The pulse is small and weak.[1]

As the urine presented different appearances from those usually observed, I sent some to Dr. Bostock, to whose kindness I am indebted for the following analysis:—"The fluid had the appearance of thin gruel, it was nearly without colour, and had a very slight urinous odour; it contained no flakes or masses of matter, and seemed to be of an uniform consistence. After remaining at rest for twenty-four hours, a thick substance began to subside, and in about thirty-six hours the upper part was become much more clear and transparent. This was poured off, and left a quantity, amounting to about one twentieth of the whole, of a semi-fluid matter, of the consistence of thick cream, of a light greenish tinge and a nauseous odour.

[1] This patient gradually sank, and died about a month after I saw him.

The clearer portion of the fluid was still somewhat opaque; it had a light primrose colour, and a faint urinous odour; it just perceptibly reddened litmus, and it passed readily through filtering paper without any apparent change.

The thicker part of the fluid, after standing for four days, showed a little tendency to further subsidence, but, in other respects, was not changed; it was adhesive, but not viscid; and it was readily diffusible through water. When examined by the microscope, a number of globules were distinctly perceived in it; and both from its physical properties and its chemical relation, I conceived that it was composed principally of albumen, in a half coagulated state, mixed with a quantity of pus.

By exposing the clearer portion of the fluid to the temperature of boiling water, and by adding to it the appropriate chemical re-agents, it was found to contain a small quantity of albumen. When this had been separated from it, it became perfectly bright and transparent, and acquired a light yellow colour.

Both the fluid and the sediment now began to evolve ammonia. A portion of the fluid after the deposition of the thick matter was slowly evaporated, and left a residuum of 1-25 per cent.; it was evidently composed of urea, and various saline substances. By digesting it in alcohol, the urea was separated, and was found to constitute 0-61 per cent., very nearly half of the whole residuum.

The composition of the clear part of this fluid was as follows, in one thousand parts:—Water 987.5, urea 6.1, salts, albumen, &c. 6.4.

According to Berzelius the constitution of healthy urine is:—Water 930.0, urea 30.1, salts, &c. 39.9.

Hence it would appear, that this urine is of the species which I have denominated aqueous, where the urea and the salts bear to each other nearly their ordinary proportion, but are considerably deficient in their absolute quantity. In addition to these it contained a quantity of semi-purulent matter, which was mechanically diffused through it, but which did not appear to affect its chemical constitution.

CHAPTER VII.

INFLAMMATION OF THE PERITONEAL COAT OF THE BLADDER, AND OF THE SURROUNDING CELLULAR TISSUE.

On dissection, we find the abdominal or peritoneal covering inflamed, as well as the mucous and muscular coats. The peritoneal covering is sometimes inflamed, from that action spreading to it from another part of the membrane; and as it is loosely connected by cellular tissue to the muscular coat, the inflammation may not be communicated to it.

There are on record, says Dr. Todd, two cases in which acute inflammation was limited to the peritoneal tunic of the organ. Dr. Baillie suggests, as a reason for such limitation to this particular tunic, the quantity of cellular tissue interposed between the serous and muscular tunic, and the laxity of their connection.

The inflammation of the peritoneal covering is seldom confined to the bladder, but extends generally over the whole membrane. It is often the close of a fatal disease of the bladder, but that it takes place under other circumstances, without any dangerous consequences, we have sufficient evidence, from the old adhesions not unfrequently found connecting this part to the omentum, to portions of the intestine, to the uterus, or to the rectum. The pain and its aggravation on pressure, the state of the pulse, the countenance, and position of the body, clearly indicate the nature of the complaint.

The treatment adopted in general peritonitis, must be had recourse to in inflammation of the peritoneal covering of the bladder. The lancet, leeches, calomel, and opium, and warm applications to the part, must be vigorously employed. The complaint rarely, if ever, proceeds to suppuration; but coagulated lymph is sometimes thrown out on the inflamed surface, forming adhesions with some part of the peritoneum, covering other viscera, or lining the cavity of the abdomen.

The inflammation of the external covering of the bladder is, however, generally connected with the inflammation of the adjoining lining of the pelvis.

In these cases, a peculiar train of symptoms occurs, requiring a different plan of treatment from that of the peritoneal inflammation of the bladder.

"The pulse," says Brodie, "is frequent, rising to 90, 100, and at last to 140, in a minute; the heat of the skin is great; the tongue dry; the countenance anxious. There is an occasional hiccough; the patient complains of some degree of tenderness in the lower part of the abdomen; the belly becomes tympanitic; the distension of the belly increases; the hiccoughs are more frequent; the pulse intermits, becomes weak and fluttering. In some instances, the patient retains his understanding, even to the last; while in others, he falls into a state of low delirium previous to death. Occasionally, in the progress of such a case, the patient has a severe rigor, and sometimes he complains of a pain in the loins. On dissection, we find the cellular membrane round the neck of the bladder, and between the prostate and rectum, bearing marks of inflammation, infiltrated with lymph and serum, and to a greater or less extent converted into a slough. If death has taken place at an early period, the intestines are found inflated with air, and there is a very slight effusion of serum in that part of the peritoneum which descends into the pelvis. But if the patient has laboured under these symptoms for many days before he dies, the peritoneum, where it is reflected from the bladder to the rectum, is seen of a darker colour than natural, and encrusted with lymph; and, at a

still later period, there is the appearance of inflammation, to a greater or less extent, throughout the peritoneum generally. But the peritoneal inflammation is evidently not the primary disease; it is the inflammation and sloughing of the cellular membrane of the pelvis, which has induced inflammation of the adjoining portion of that membrane.

"It is important that we should not fall into the error of regarding these cases as cases of simple peritoneal inflammation, for the remedies which would be useful in the latter case are useless here. The abstraction of blood, even the operation of an active purgative, will cause the patient to sink more rapidly, tending only to hasten his death. The proper system to be pursued is the opposite of that to depletion. The patient should take such nutriment as his stomach is capable of digesting. The bowels may be kept open by injections, or by the exhibition of some very gentle purgative; and ammonia, wine, and brandy, are to be administered when the state of the general system indicates that stimulants are necessary."

The cellular tissue surrounding the bladder is sometimes the seat of chronic disease, and abscesses may form in different parts without the bladder being affected. These cases are always involved in great obscurity, and often terminate fatally.

CHAPTER VIII.

FUNGUS HÆMATODES AND CANCER OF THE BLADDER.

Fungous excrescences occasionally arise from the inner surface of the bladder, and are productive of most distressing symptoms, often very similar to many of those which attend the stone. These excrescences are different in their size, and in the extent of surface which they occupy. Sometimes they originate from a single root, and occasionally from several; but they generally consist of a similar loose and fibrous structure. In certain situations, as when immediately behind the neck of the bladder, they will, by blocking up the origin of the urethra, cause a very considerable obstruction to the passage of the urine; and the bladder being irritated, and frequently excited by them to stronger action than in a natural state, its muscular coat becomes thickened. These excrescences are sometimes attended with a discharge of blood, and of a viscid ropy mucus, the result of irritation of the inner membrane of the bladder, and with pain along the urethra, and at the glans penis. The glands in the groins and pelvis usually become enlarged.

"There is a malignant medullary fungus," says Mr. Travers,[1] "of the mucous coat of the bladder, resembling that of the nares

[1] Medico-Chirurgical Transactions, vol. xvii.

and uterus, breaking and bleeding, and reproduced as quickly as it is displaced. It is of very extensive attachment, and gradually reduces the cavity to a very small dimension. Portions of fungus, and coagula of blood, become plugged in the urethra, and form firm pellets, so as to produce retention. It is a very painful disease; keeps the patient in constant anxiety to void urine, which is more or less tinged with blood, and frequently he passes blood alone. He dies hectic and wasted."

In a case of fungus hæmatodes, which Mr. Mayo examined with the late Mr. Wilson, in which the existence of stone had been suspected, from pain in the bladder and occasional discharge of blood, a fungus was found attached by a narrow pedicle to the mucous membrane; the texture of the fungus was soft, and its surface shreddy and ragged. In a patient of the same gentleman, who died in the Middlesex Hospital, with medullary sarcoma affecting the uterus and neighbouring part of the vagina, the bladder was studded with little white tubercles, about the size of peas, which had formed behind the mucous coat, but projected inwards. They appeared, when cut through, of the same medullary texture with that which grew from the uterus and vagina.

"In these cases," says Sir B. Brodie, "the patient complains of a too frequent inclination to void his urine, and of an uneasy sensation referred to the neck of the bladder, which sometimes amounts to severe pain, extending to the perinæum, and along the urethra to the glans, and in another direction to the pubes. This pain is generally aggravated after the urine is voided. I have known the patient to labour under a retention of urine in consequence of the tumour pressing on the inner orifice of the urethra, so that it may become necessary to puncture the bladder above the pubes. In another case, there was a constant wearing pain in the loins, the cause of which was explained by the appearances observed in the post mortem examination, the tumour having obstructed the orifice of the ureters, which were in consequence dilated to the size of the small intestine, the pelvis and infundibula of the kidneys being dilated also, so as to form considerable sacs or pouches, distended with urine."

There is always a disposition to hemorrhage, and it is sometimes so great as to be the immediate cause of the patient's death. The urine also frequently contains small portions of the medullary matter.

In some cases of cancer of the rectum in men, and of the womb in females, the disease is communicated to the bladder; ulceration of this organ takes place; and a communication is established between the rectum and the bladder, and between this last and the vagina, a circumstance which renders the patient's state most deplorable. It is doubtful, however, whether the ulceration be of a true scirrhous character. Mr. Travers says, in the paper just quoted, "I never saw scirrho-cancerous ulceration of the bladder; scrofulous often, particularly in children. When the bladder adheres extensively to the rectum in the cancer of the latter, and

when they communicate by a fistulous aperture, so that air passes by the urethra as well as feculent urine, I have not seen the coats of the bladder presenting the appearance of scirrhous cancer. The vagina and rectum in the female are, on the contrary, indistinguishably affected by the scirrhous ulcer and fungus."

In these cases, all that we can do is to allay the pain and irritation by the use of sedatives, taken internally, and in the form of suppositories or injections, introduced per anum. The bleeding is sometimes so great as materially to exhaust the powers of the patient. In such cases, our endeavours must be directed to restrain the bleeding,[1] and, at the same time, to sustain the powers of life without increasing the local excitement. Astringents should be given internally, and the patient should ke kept in the horizontal position. Too much stress cannot be laid on the necessity of keeping the patient in this position; for in severe hemorrhage from the bladder, particularly in old persons, syncope has come on whilst the patient has been sitting up, or exerting himself, and death occurred. The powers of life are generally much exhausted; and the urine is often alkaline, containing albumen, and a large proportion of the phosphates.

I may, perhaps, observe here, that when albuminous urine is alkaline, it is sometimes incapable of being coagulated by heat. It was supposed that this depended on the presence of some fixed alkali, which held the albumen in solution. Mr. Rees made an analysis of two different specimens of urine taken from the same individual: one was neutral, and coagulable by heat; the other was not coagulable by heat, and possessed an alkaline reaction. From the analysis, it appeared that the alkaline specimen contained the greatest proportion of albumen, and a much smaller proportion of alkaline salts than the neutral urine. This goes strongly, he observes, against the probability of any fixed alkali being the solvent of the albumen; for in this case we should expect a redundant quantity of fixed saline matter, in proportion to the albumen present, whereas exactly the opposite was the result.

If the urine be very alkaline in these cases, the decoction of the pareira brava, with the nitric acid, will be very serviceable; on the contrary, if the urine becomes acid, the uva ursi, with the fixed or volatile alkalies, will be the most appropriate remedy.

[1] The following will be found very serviceable in these cases:—R. Infus. rosæ comp. ℥ vj.; aluminis pulv. ʒ ss.; gallarum pulv. ʒ iss.; acid. sulph. dil. ʒ i. mix. Two tablespoonfuls to be taken every four hours.

CHAPTER IX.

FOREIGN BODIES IN THE BLADDER; OPERATION FOR STONE.

Several instances of hair voided by urine, are mentioned by Sir Hans Sloane; one particularly of a brewer, who suffered from the occasional passage of long hairs, matted or woven together, passed with great pain, but with little or no calculous matter attached to them. Mr. Powell relates a case of a middle aged lady, who, after being teazed with disordered stomach and bowels, and the evacuation of whey-coloured and fetid urine, passed little masses of hair, mingled with a peculiar viscid mucous substance, partly crusted with calculous matter. The extrication of these substances was attended with aggravation of the distress and pain in the bladder, from the urine bringing them into contact with the orifice of the urethra. This complaint, which continued long, induced great weakness, and total loss of flesh. Dr. Wallace, also, met with an instance, in which hair was several times voided with the urine; and on the body, after death, being examined, a stone was found in the bladder, large as a goose egg, from parts of which hairs had grown out. It was thought that the hairs voided during life, which were a great many, and some of an extraordinary length, grew out of that stone; because when the hairs hung out of the urethra, as they frequently did, to his great torment, they were obliged to be pulled out, which was always done with a resistance, as if plucked out by the root.[1]

Musket balls have found their way into the bladder, sometimes occasioning very little inconvenience, at other times giving rise to very distressing symptoms. Larrey, Ballingall, and other writers, mention cases of this kind.

"Some time ago," says Mr. Ingleby,[2] "I was called to a woman, a female catheter having unfortunately been allowed to pass entirely into the bladder. The patient was in the fourth month of pregnancy, and had experienced a retention of urine, by no means uncommon, just before the uterus finally quits the pelvis for the abdomen, but in this instance occasioned by the womb being considerably prolapsed—a circumstance which it is material to mention. At the time I saw the patient, the catheter had been in the bladder eight hours. It lay in the centre of the organ, quite transversely; and, the urine having dribbled away, the bladder was in as contracted a state as the catheter admitted of. By means of a long and very slender pair of forceps, passed per urethram, I embraced the instrument near one end, and with the two fore-fingers of the left hand, passed by the vagina, carefully elevated the other end; and having thus brought it into the horizontal

[1] Howship, op. cit., p. 167.
[2] On Uterine Hemorrhage, p. 106.

direction, gently extracted it. As little injury as possible was inflicted upon the patient; nevertheless, the ovum was discharged on the third day, but without hemorrhage. The fœtus presented a perfectly white and beautiful appearance; the scalp excepted, under which there was a considerable extravasation of blood; and to mechanical injury (occasioned, no doubt, by the difficulty in giving the catheter the horizontal direction), its death may be directly ascribed."

Mr. Toogood, of Bridgewater, has recently published, in the Medical Gazette, two interesting cases, where the female catheter slipped into the urethra. In both cases, the instruments were extracted by dilating the urethra by the sponge tent, so as to enable the fore-finger to be introduced into the bladder. Mr. Key and myself saw, two or three years ago, a case, where three inches of a thin gum elastic catheter broke in the urethra, near to the bladder, and although we were called to the gentleman immediately after the occurrence of the accident, we could not lay hold of the broken portion. Three weeks after this, the fragments (for there were two, one an inch in length, and the other two inches) were voided by the urethra. From the fortunate termination of this case, I came to the determination always to wait, in similar cases, before recommending an operation. An interesting case has been published by Mr. Tyrrell,[1] where a patient, in whom a catheter broke in the urethra, and escaped into the bladder, came under his care. The following plan was successfully adopted for its extraction:—The patient was placed on a bed in a half sitting posture, with his thighs semiflexed; the sound which had been previously introduced, being withdrawn. Mr. Tyrrell then introduced one of Weiss's instruments for extracting small calculi, which was nearly straight, and had a strong spring. By careful examination with it, he discovered that the extremity of the foreign body towards the patient's right side was free, and that the other was covered with a fold of the bladder. After several unsuccessful attempts, he succeeded in seizing the free extremity with the instrument, and by withdrawing it very cautiously, brought the piece of catheter into the urethra, when the forceps slipped from it. Mr. T. immediately introduced his finger into the rectum, for the purpose of compressing the urethra between the foreign body and bladder, so as to prevent any retrograde movement of the former. This being secured, the forceps was again introduced into the urethra, and in the first attempt, the piece of catheter was laid hold of, and extracted.

If the foreign body be not passed by the efforts of nature, or cannot be extracted by means similar to those which were adopted in the case just described, the same operation as for stone, should the urgency of symptoms render surgical assistance necessary, must be resorted to.

Hydatids have been discharged from the urethra, and numbers

[1] Vid. St. Thomas's Hospital Reports.

of them have been found after death floating loose in the bladder. In such cases, it is most probable that they have descended from the kidney along the ureters, or that they have been introduced into it from a cyst formed in the pelvis, which had opened by ulceration into the bladder. Worms have been also discharged with the urine; an instance of which is related by Mr. Lawrence, in the Medico-Chirurgical Transactions.

The formation and symptoms of urinary calculi have been so ably treated by Marcet, Prout, Brodie, Crosse, and others, that I must refer my readers to the works of these authors, for information on this interesting subject. I will, however, insert here the following observations on the operation for stone, which were delivered by me, some time ago, in a clinical lecture; and I have, since that period, found no reason to alter the views which are here advanced. Prior to performing the operation for stone, the surgeon should be extremely particular in preparing his patient by those means which experience has shown to be best conducive to this end. Celsus was aware of the necessity of bringing the patient into a fit state for the operation, by diet and abstinence; in fact, the most successful lithotomists are those who are most attentive to this point. If the patient's health is much impaired, and the bowels are relaxed, which is not unfrequently the case in children, or if the urine is alkaline, you must, before the operation, lessen the irritability of the bladder and bowels by an anodyne, and improve, as far as you can, the patient's health, by medicine and attention to diet. I generally give, on the night preceding the operation, a few grains of hydrarg. c. creta, with the pulv. rhei, and early on the following, some castor oil. Two clysters should be given before the operation; one, two or three hours after the oil, composed of gruel, olive oil, and salt; and the other, about an hour before the operation, with common gruel and twenty or thirty drops of laudanum in it. If, when the surgeon arrives to perform the operation, the last injection has not come away, he should urge the patient, if he be an adult, to go to stool; if, however, it is a child, it will generally happen, that if the injection has not passed off, it will do so at the time the staff is introduced. On no account should the surgeon undertake the operation till the injection has come away. The patient should be placed on a table of sufficient height, so that the perinæum be opposite to the breast of the surgeon. The table should rather be a little too high than too low, for it will be an advantage to you in the operation, to be a little under your work rather than above it. After the patient is bound, his shoulders and back should be raised and supported with pillows; he should be brought to the edge of the table, and his thighs be widely separated by an assistant; but it is of great importance that the nates be kept straight, and that an inclination be not given to one side more than the other. I now introduce a curved staff, and give it to the care of an assistant. You no doubt observed, that Mr. Pereira, who held the staff for me, gave to the instrument a different direction to that in which it is usually held. Instead of

holding it perpendicularly, or nearly so, Mr. P. inclined the handle a little towards the ground, with the groove turned towards the left side. By this inclination of the handle, you certainly make the groove of the staff less prominent in the perinæum; but there is this advantage, when you have cut into the groove, you have no occasion to alter the position of the staff, and the fore-finger of your left hand is quite at your disposal for protecting the rectum, and guiding the knife. I find that I can perform the operation much more rapidly in this way, than by taking the staff into my own hand. M. Langenbeck is a strong advocate for this mode of holding the staff; he, however, advises the handle to be inclined still more towards the ground than I do. I begin the first incision rather low, about two fingers breadth above the anus; the bulb of the urethra will be then avoided. In fact, the external incision, if commenced higher up, can be of no use to you; and I find that this, the upper part of the wound, is often the slowest to heal. Respecting the remaining steps of the operation, I have little new to offer. For the division of the prostate, I use the long straight knife, with the beak in the middle line of the point. I began in 1828 with the gorget; but whatever merits this instrument may possess in the hands of an experienced operator, I feel confident that, for a beginner at least, the knife is the safest and best instrument he can employ. If any hemorrhage occur, you must endeavour to compress the bleeding vessel with your finger.

The after treatment consists, if no inflammatory symptoms ensue, in merely keeping the patient quiet, though it is extremely difficult to carry this into execution with children. The knees, by some surgeons, are tied together; by others they are not; but they should always be kept raised, and the scrotum supported. No application is required to the wound; but the urine should be received on sponges, and the parts kept clean; some urine soon begins to flow through the natural passage. In a man above sixty, on whom I operated some time ago, a considerable quantity of water came through the urethra on the morning following the operation. The time, however, varies at which the water entirely ceases to pass through the wound; and, in some rare cases, urinary fistulæ remain.

Inflammation and suppuration of the cellular tissue surrounding the bladder, are invariably found after fatal operations for lithotomy, attended with the symptoms which have been already described in Chapter VII.

CHAPTER X.

WOUNDS AND INJURIES OF THE BLADDER.

"Wounds of the bladder," says Liston,[1] "within the peritoneal sac, or even behind the reflection of the pelvis fascia, are almost inevitably mortal; they may be inflicted from without, by pointed weapons, or from within, as in rash and ill-conducted operations for stone; or they may be the result of violent injury and solution of continuity in the bones of the pelvis. I have seen some accidental wounds of this viscus, from which patients have recovered very favourably. A wound of the posterior fundus, through the rectum, if it does not pass beyond the bladder, is not necessarily attended with great risk." Foreign bodies, as bullets, have entered the viscus at various parts, the immediate effects of which have been recovered from, and their removal has, after a time, been accomplished by incision of the perinæum.

In fractures of the bones of the pelvis, the bladder is often injured, either by the force of the concussion, or by a spicula of the fractured bone penetrating the coats of the bladder.

I have known the bladder ruptured by a fall from the top of a coach. A gentleman was riding on the box, with his own coachman, when the carriage was upset, and the coachman fell on him, by which accident the bladder was ruptured. The patient lived from the Sunday till the following Wednesday.

The bladder is sometimes ruptured by external violence, in boxing matches. In these, if one throws the other on the ground, he may fall upon him with his knees; and, as the bladder may then be full from previous drinking, its rupture has occurred.

The bladder, when excessively distended, may give way; a case of this kind is mentioned by Sir E. Home,[2] and another by Dr. Johnstone.[3] In such cases, the urine escapes into the cavity of the pelvis, and all that we can do, is to introduce a catheter, and leave it in the bladder, in order to limit, as much as possible, the quantity of effused urine.

These cases almost always terminate fatally; and on examination, the cellular tissue of the pelvis is found in an inflamed, or rather sloughing state.

The bladder has been known to burst in cases of labour; and most practitioners concur in thinking that such an accident must always be the effect of neglect or improper interference. One cause of laceration of the bladder may be the use of instruments in a distended state of this organ. If the forceps are applied whilst the bladder is full, the action of the instrument is likely to produce

[1] Practical Surgery, p. 393.
[2] Home on Strictures, vol. ii. p. 241.
[3] Memoirs of the Medical Society, vol. iii.

laceration of the bladder, and this is known by the immediate and constant flow of urine through the opening.

In consequence of the undue pressure of the head of the child, destruction of a portion of the vagina and bladder takes place; and this occurrence is attended with most distressing symptoms. The urine dribbles away as fast as it is secreted, and excoriates the neighbouring parts. The protruded mucous surface of the bladder is very sensitive, and the vagina is frequently contracted in size by firm bands, extending across it in different directions. With all these local symptoms, the patient's general health is but little affected. I have seen four or five instances of this complaint, in all of which little could be done in the way of relief. The late Mr. Earle published, in the fifth volume of the Medical Gazette, a valuable paper on this complaint, an abstract of which I subjoin.

The sources of difficulty attending these cases are manifold. One is, the continual flow of urine, and the vicinity of the termination of the ureters. Another is the very narrow space for performing any operation, often rendered more narrow by preternatural contractions, and firm cicatrised bands. A third source of difficulty in attempting any operation, arises from the exquisite sensibility of the exposed mucous membrane of the bladder. Next, the moist, unresisting, elastic surface, eludes the impression of any cutting instrument, the edge of which is almost immediately blunted by the action of the urine. Even when these are surmounted by perseverance, and a modification of the various instruments, such is the influence exerted over the pelvic viscera by the slightest movements of the viscera of the abdomen, and by the action of the abdominal muscles and the diaphragm, that the adaption of the denuded surface is often frustrated, and even the sutures forcibly torn away, by a single effort to cough or sneeze.

"When the opening," continues Mr. E., "is not situated between the urethra and ureters, or in the neighbourhood of the latter tubes, when it is not of great magnitude, and when there is not much hernia of the bladder, we may attempt to remove the callous edges, and unite them by the assistance of sutures. We shall be much facilitated in this operation by previously dilating the urethra sufficiently to admit the fore-finger of the left hand; by which we shall be enabled to draw down the bladder, and to afford a support and resistance in removing the edges. The instruments best adapted for this purpose, are very narrow double-edged scalpels, or lancets, with which we may pierce through the membranes, and cut our way outwards. These should cut only to a short distance from the extremity. It will be better to commence at the extreme edges of the opening, and not to attempt to effect too much at any operation. By several operations, we may gradually diminish the aperture, but by attempting too much, we shall be foiled altogether. In order to convey a suture through the edges, to hold them in contact, it will be necessary to employ port-aiguilles, with grooves, which will hold a short triangular glover's needle at different angles, and with slides adapted for holding or letting loose the

needle. The following is the mode in which I have employed this. An armed needle should be fixed at the angle most convenient for piercing the denuded edges of the wound, which should be directed by the finger, and carried through the two edges. The point should be received by the other port-aiguille, and the slide pushed up to fix it. The slide of the first should then be drawn down, which will leave the needle in the grasp of the second, by which it may be drawn through with its thread attached. To effect this in so narrow a space as the vagina, is often most difficult, and requires much patience and dexterity. The ligature should be drawn tight, and the ends cut off. I have also employed short hare-lip pins, and the twisted suture; but these are still more difficult to pass, and cause much more irritation. In those cases which, from the situation of the opening, or its magnitude, no curative means can be attempted, a well adapted truss, with an elastic gum pad, will often enable the patient to retain a considerable quantity of water, and to enjoy comparative comfort."

THE

CROONIAN LECTURES,

FOR 1838.

BY JOHN CLENDINNING, M.D., F.R.C.P.

EXPERIMENTS AND OBSERVATIONS RELATING TO THE PATHOLOGY AND PATHOLOGICAL RELATIONS OF THE HEART.

INTRODUCTORY REMARKS.

In physiology, healthy and morbid, there may be distinguished two great classes of functions, which differ very much from each other in the laws which govern them, and the elements and agencies by which their ends are effected. I mean, first, those that are constituted by powers which are dynamic, or *vital simply*, such as those peculiar to the sensorium, to the muscular fibre, to the blood, and the analogous powers and actions in the vegetable physiology—functions whose peculiar conditions and phenomena admit of no mechanical, chemical, or other physical explanation. And secondly, those functions that are of a mixed nature, and to the effectuation of which, organic powers and purely vital properties contribute but in part, often but indirectly, and in which material elements, as carbon, oxygen, &c., and physical forces, chemical or mechanical, are the principal agents. Of the latter, or mixed class, are the visceral functions, with the exception of those of the encephalon and spinal brain; the functions, also, of the secreting surfaces; and generally all those involuntary actions, organic and humoral, that contribute to the work of *nutrition*, whether in a principal and direct manner, as those of the heart, stomach, and lungs; or merely secondarily, and as subsidiaries, as appears to be the duty of the liver, spleen, pancreas, kidneys, skin, and lower intestines. Of these two classes of functions, the former, or the purely dynamic and vital powers and functions, possess in themselves a high and peculiar interest. They are most variously and amply developed in the higher animals, and stand out most prominently in that department of organic nature in which alone man can justly claim for himself pre-eminence above other animals; I mean the moral and intellectual. They have likewise peculiarly mysterious laws, energies, and modes of operation; and at the same time have very extensive relations to, and exercise vast disturbing and otherwise modifying powers over, the material elements and forces, amid which, and by the support of which, they exist in the organisms. Owing to these and other causes,

the constitution and government of the nervous organs have of late been very laboriously investigated; and, considering the imperfection of the methods used by many enquirers, have been investigated with much success; and from those researches unquestionably some advantage has been derived in clinical practice, and more may in future be expected.

PARAMOUNT IMPORTANCE OF THE NUTRIENT FUNCTIONS IN GRAVE DISEASES.

But it does not seem to be from that quarter that the largest accessions to curative power may be looked for, but rather to researches calculated to elucidate the laws of functions less ethereal and noble than those that refer to the external world, and the continuation of the species; those functions, namely, whose appropriate end is the preservation of the individual, and which, collectively, may, in a large way of speaking, be called the *nutrient functions*. The functions of relation, both the sensorial and the sexual, have paramount interest and importance for the moralist, the naturalist, and the philosopher; indeed, of every colour and character of mind. But to the practitioner of medicine, the paramount function is that of *nutrition* broadly understood, so as to include all the viscera of the chest and abdomen, with their dependent tubes and appropriate stimuli.

The nutritive forces are those that operate the growth and decay of the structures, and determine the character, and regulate the amount of those organic and humoral powers and capacities which are the material causes of life. Almost all grave diseases, whether acute or chronic, are complicated with, or even dependent on, organic changes of condition, implying *abnormal nutrition;* for example, inflammations, acute and chronic, common and specific; and, in fact, all the varieties of the phlogistic process; also, in popular terms, all dropsies, consumptions, asthmas, and palsies, which are at present the great outlets of life, and are known to depend on various modifications of nutrient action in the brain, heart, and lungs. And as the suffering and mortality of such diseases are the results mainly of irregular efforts of the *nisus formativus* or *nutritivus*, which seem to me to be in effect the same thing, so the cure of them must consist mainly either in repressing that force, or stimulating it, or altering its direction.

And the relative importance of the nutrient function, as a subject for professional study, and medicinal regulation, in the treatment of grave diseases, is, it is conceived, still more important in the present than in former ages; and for this reason. Of late years, disease has apparently become more simple as a whole, by the abstraction of a large part of the humoral depravities, that seem to have been main causes of the mortality of the plagues and epidemics in general of past ages. The less favourable crasis of the humours alluded to, appears to have originated from various causes in various combinations, especially in frequent scarcities and famines; in habitual excess in salted food, and deficiency of

wholesome vegetable food, during the winter and spring seasons; and in defective domestic and personal cleanliness; and defective atmospherical purity at all times. To the preceding may be added, frightful abuse of alcohol by all classes; and very unskilful use of authority in what was intended for wholesome regulation of industry by legislators and magistrates; and, as a consequence of all the circumstances referred to, extreme mental depression, interrupted only by occasional convulsive excitement in the dark and miserable masses. To all these popular conditions, as remote causes, I would attribute those abnormal states of the vital powers in solids and fluids, which sprang more immediately, of course, out of extremely defective composition, distribution, and depuration of blood; and which, however caused, gave to the endemic and epidemic diseases of those times a tendency to maculæ, hemorrhagic exudations, fetid and otherwise foul and anomalous excretions, with asthenic delirium or typho-mania, &c. &c.—in a word, to intense malignity of disease, humoral and nervous, such as we now rarely witness; and which, should it reappear, would now, as then, unquestionably produce frightful mortalities and devastations. Now, such causes of humoral vitiation and anomalous vital conditions, and, in general, of inferior tenacity of life, no longer existing in their former intensity to complicate morbid states and mask diseases, it results that disease consists at present more in simple defect or excess, material or dynamic, and less in perversion or qualitative changes; and that, therefore, the business of treatment is more simple, and, owing to its greater simplicity in great part, more efficient. Also, that from the mitigation of many causes of malignant disease, and the apparently superior average tenacity of life, the chronic class of disorders preponderates over the pestilential and acute; or, in other words, those diseases recede, in which the frailty of the subject, and the intensity of the morbific agencies, leave little room for curative skill, from the rapidity of their march, or the mysterious complexity of their causes and symptoms; while those other diseases advance in relative frequency and importance, whose slow progress and protracted duration give time and opportunity for the safe and efficient employment of the resources of a therapeia as yet very limited in its means, to a great extent merely tentative in its nature, and in its daily exercise restricted by various considerations and circumstances, moral, physical, and prudential.

SPECIAL OCCASION AND OBJECTS OF THE ENQUIRY.

Under such impressions, whether erroneous or not, it has long seemed advisable, that the especial attention of such pathologists as are practitioners, and have opportunity, should be fixed on the vast and complicated apparatus whose end is *nutrition;* or the due preparation, purification, and distribution of nutrient fluids; and that to increase the probabilities of success, it would always be advisable to use, where practicable, *instrumental aids* to observa-

tion, and to adopt simple but accurate methods of recording the results; and thus to depend as little as possible on *conjecture* in observing, or on *memory* in recording. And so far as opportunity permitted, I have myself acted on those views, more especially as regards the great organ of nutrimentary distribution—the heart; and although I have by no means completed the limited enquiries, which, as not beyond my powers or opportunities, I have conceived myself warranted in attempting, yet I have, I imagine, already arrived at some results, not, so far as I know, generally known, and yet of some interest—results which I propose to make the subject of the present lectures.

IMPORTANCE OF ACCURATE KNOWLEDGE OF HEART DISEASE.

I have already stated that the especial object of my enquiries has been the pathology and pathological relations of the heart. My attention has not, indeed, been limited to that organ; on the contrary, it has been endeavoured to embrace in the enquiry all the viscera; but the heart has been the especial object of observation, and that for various reasons, but principally this, that I found disease of the heart, simple enlargement with thickening usually, in a large proportion of fatal cases of adults, whatever might be the name or supposed proximate causes of the diseases preceding death; so that, in male adults, *morbus cordis* seemed, in official practice at least, to occur more frequently than phthisis, which I had previously believed to be, at all ages above puberty, the principal fatal disease of these climates. And further, this contributed to fix my attention on the heart, viz. that in almost all the cases of asthmatic and chronic catarrhal or bronchitic disease that I had met with in persons of mature years, and especially in males, in eight and even nine cases out of every ten, I thought I met with hypertrophy of at least the left ventricle of the heart. Such perpetually recurring disease of the heart, either as a direct cause of death, or as a complication of fatal diseases of other organs, seemed to warrant the opinion that to the heart might be attributed a large share of the fatality of many diseases and cases of diseases in which no suspicion had been entertained of any defect in that capital organ. I had also had several opportunities of feeling the want of some standard or measure of health more accurate than the *closed fist* of the subject, which seems to have satisfied the illustrious Laennec; having on several occasions known hearts to prove decidedly hypertrophous by instrumental measurement, which had by able anatomists and highly-informed pathologists been previously pronounced normal, more especially in cases where death had supervened quickly on acute complaints, and where no important lesion was observable of the valves, pericardium, or aorta.

DEFINITION OF HEALTH IN THE HEART BY MEANS OF INSTRUMENTAL MEASUREMENT.

The facts just alluded to, and more especially those last referred to, suggested the propriety of endeavouring to define, as precisely

as might be, the limits of health and disease with respect to that organ; and especially to fix as accurately as I could the limits of healthy development and nutrition, as opposed to the hypertrophous state on the one hand, and the atrophous on the other. The object just stated I selected for enquiry before others, for several reasons, especially these two—that it was *easier*, as admitting more fully of instrumental assistance, and that it was *more necessary*, as being peculiarly useful in the study of hypertrophy, which I soon convinced myself was the principal element in importance, because the most frequent of occurrence, and the most extensively mischievous element in diseases of the heart. For the purpose just stated, then, measurement by bulk and linear measurement, as well as measurement by weight, presented themselves for adoption. But I found linear observation too difficult and uncertain, from variability and irregularity of shape, from organic flaccidity, and other mechanical circumstances; and measurement by bulk, in a fluid contained in a graduated vessel, I found to be but partially applicable, owing especially to the wide distance between the extremes—between enlarged adult livers, emphyhsematous lungs, &c., on the one hand, and infant hearts, cerebella, spleens, &c., on the other; so that I found measurement by weight in air the only method generally applicable and convenient, and the only mode at all quite obviously by which the ratio of any viscus of the whole person could with any approach to precision be attempted to be ascertained. This mode I likewise found abundantly *accurate*, as well as easy in practice. I accordingly extended to the heart the practice of measurement by weight, previously applied to the encephalon by several observers, and on the largest scale, and with most success, by my friend, Dr. Sims, as evidenced in his instructive paper published in the 19th volume of the Medico-Chirurgical Transactions; applied to some extent also in France to the heart itself by Bouillaud, as previously by Senac, and cotemporaneously by Lobstein, Cruveilhier, &c.; also by Meckel, in Germany, and some others.

This method of measurement by weight, for reasons hereafter to be stated, was subsequently extended to all the viscera where practicable, and as often as possible was made to include the person of the subject likewise. To measurement by weight were added, in many instances, measurements also by bulk, with the view of determining the density of the viscera in various conditions; and these observations have been now long enough in progress to admit of inferences, founded in several instances on facts, occurring in several hundred subjects.

Early last year I had the honour of laying before the Royal Medical and Chirurgical Society a paper, communicating some of the conclusions first arrived at, and founded on observations embracing between two and three hundred subjects. Since that time, owing to the kindness of several friends in great part, I have been able to enlarge my facts by new accessions to double the number at my disposal last year, and am thus in a position to

repeat, with additional evidence, certain statements of that paper, and to mention other additional results not known to me, or (for reasons not necessary to mention here) not stated on that occasion.

The first step, then, appeared to be, to determine, with as much precision as my materials would admit, the normal dimensions of the heart, its normal bulk, weight, and density.

From want of precise data on this point, it appeared that mistakes had been made from time to time by pathologists and practitioners, which might otherwise have been avoided. Diseases and symptoms, properly referable to the heart, have often been ascribed to pulmonic affections, or to chronic disorders of the liver, or spleen, or other abdominal viscus; and in cases of complicated disease, in not a few instances, disease of the heart, not including valvular defect or pericarditis, has been entirely overlooked, and the whole of the morbid actions referred to other organs, themselves probably in many cases not principals in the morbid causation, but merely secondarily affected, and in consequence of the disease at the centre of circulation. Of this there will heareafter be proof offered, consisting of facts and inferences that have convinced my own mind at least, that much as has been written on diseases of the heart, it still remains to be determined with precision what constitutes disease of the heart—what are the anatomical and physical evidences of the most important species of disease of the heart—or, in other words, what limits divide hypertrophy from normal nutrition of that organ.

NORMAL ABSOLUTE WEIGHT AND VOLUME OF THE HEART.

With a view, then, to determine the normal dimensions, &c., of the heart, nearly four hundred hearts were examined and weighed, and distributed into groups in tabular forms, distinguishing age and sex, and placing all cases of *morbus cordis* and of *phthisis* apart from the other cases, for reasons which, if not obvious, will presently appear. It is proper to mention that the diseases of almost all the subjects of observation are known, and that in most cases pretty full notes exist of the morbid appearances, and are in my own possession.

The first part of the table contains the weights of between eighty and ninety hearts of males above puberty, who died of various diseases, not morbus cordis or phthisis, and distributed into groups or columns, according to age, viz.—

15 to 30 years of age.
30 to 50 " "
50 to 70 " "
70 to 100 " "

The second part of the table contains like particulars, regarding more than one hundred female subjects, dead of other diseases than pulmonary consumption, or disease of the heart, and distributed in similar groups or columns, according to age.

Now, according to the first part of Table I., containing normal

hearts of males, we have as our average for the years 15 to 30 (68 oz. 10 dr. ÷ 8 =) 8½ oz., which is nearly the average assumed in the paper above alluded to for the whole of life. For the ages 30 to 50, we have for the average weight (228 ÷ =) 9½ oz.; and if we exclude from the total, of which the quotient is 9½, such hearts as exceeded 11 oz. in weight, which is an ounce above the ordinary limit of health assigned by Senac, Lobstein, Meckel, and Bouillaud, and much more above the normal standard according to Cruveilhier, we shall then have (228 — 93 ÷ 16 =) 8·85, or 8⅞ oz.

Then in the next interval of age we have 33 hearts, giving an average (336 ÷ 33 =) 10·17 oz. or 10⅛ oz.; and if we exclude from the division, 10 hearts of 11 oz. and upwards, as in the last case, we have a net average of 9·33 or 9⅓ oz.

In the fourth interval of age, viz. 70 and upwards, there are 15 hearts giving a gross average of 10½ oz.; and excluding 4 of 11 oz. and upwards each, we have a net average of 9·75 or 9¾ oz., and for the whole four columns we have a gross average of 9·45, and a net average of 9 oz., for the life of males above 15 years of age.

In like manner, in the second part of the table, we have for females the following averages, viz:—

15 to	30	years	of age	gives	8·14 or 8⅛ oz.
30 to	50	"	"	"	8·33 or 8⅓ oz.
50 to	70	"	"	"	8 oz. nearly.
70 to	100	"	"	"	8 oz.

And the whole four columns give an average for life of 8·26 or 8¼ gross average, and 8·12 or 8⅛ oz. net average, from puberty to extreme age.

COMPARISON OF ESTIMATES.

Now, with respect to those averages, I may remark, before proceeding farther, that they agree very well with the estimates of Senac, Meckel, Lobstein, and Bouillaud, which were deduced from much smaller numbers apparently, and which are:—Senac, 8 to 10 oz.; for Lobstein, 9 or 10 oz.; for Meckel, about 10 oz.; and for Bouillaud, for both sexes, 8½ oz., nearly avoirdupois; and there is much reason to believe, that if they had attended to distinction of age and sex sufficiently, which it is clear none of them has done, their estimates would still more closely correspond with those of the present tables. Cruveilhier's estimate, I must however observe, agrees very indifferently with mine; but I may add, that it does not, so far as I know, appear that he drew his averages from a total sufficiently large, and there is good reason to think that he too paid inadequate attention to the distinctions of sex and age. His estimate for the healthy adult heart is 6 to 7 ounces—an estimate too low, according to my observation, for any age above 10 or 12 years, or for any class of patients except females dead of cancer.

TABLE I.

Table of *Hearts*, divided into four sections, according to age, namely, 15 to 30 years of age, 30 to 50, 50 to 70, and 70 to 100, distinguishing the sexes, and giving total number of observations, total weights, and average weight for each interval of age and each sex, and distinguishing phthisis and morbus cordis from all other diseases and cases; and adding for each class the average for life above puberty.

		15 to 30			30 to 50			50 to 70			70 to 100				
		No. of Obs.	Total Weight.	Average	No. of Obs.	Total Weight.	Average.	No. of Obs.	Total Weight.	Average.	No. of Obs.	Total Weight.	Average.	Total of Obs.	Average for life above fifteen.
Varia exclusive of phthisis, &c.	* *Gross* Totals and averages.	8	oz. dr. 68 10	$8\frac{1}{2}$	24	oz. dr. 228 2	$9\frac{1}{2}$	33	oz. dr. 336 2	$10\frac{1}{6}$	15	oz. dr $156\frac{1}{4}$	$10\frac{1}{2}$	80	9·45
Varia exclusive as before.	† *Net* Totals and averages.	8	68 10	$8\frac{1}{2}$	16	135	$8\frac{1}{2}$	23	215	$9\frac{1}{3}$	11	107	$9\frac{3}{4}$	58	9·00
Phthisis, averages, &c. . . .	Males.	11	$86\frac{3}{4}$	8	19	$181\frac{3}{4}$	$9\frac{1}{2}$	17	$160\frac{3}{4}$	$9\frac{2}{5}$	3	$28\frac{1}{4}$	$9\frac{1}{3}$	50	9·06
Morb. chron. cordis.		5	$72\frac{3}{4}$	$14\frac{1}{2}$	24	$409\frac{1}{4}$	17	34	$513\frac{3}{4}$	15	13	195	15	76	15·33
Varia exclusive of phthisis, &c.	* *Gross* Totals and averages.	20	163	$8\frac{1}{7}$	31	$266\frac{3}{4}$	$8\frac{3}{5}$	30	245	$8\frac{1}{6}$	24	$186\frac{1}{4}$	$8\frac{1}{6}$	105	8·26
Varia exclusive as before.	† *Net* Totals and averages.	20	163	$8\frac{1}{7}$	28	233	$8\frac{1}{3}$	27	212	8	23	184	8	98	8·12
Phthisis.	Females.	8	$56\frac{1}{4}$	7	8	70	$8\frac{3}{4}$	9	69 10	$7\frac{3}{5}$	2	14 10	$7\frac{1}{3}$	27	7·47
Morb. chron. cordis.		5	$61\frac{3}{4}$	$12\frac{1}{5}$	8	99	$12\frac{3}{8}$	16	234 14	$14\frac{1}{2}$	14	175	$12\frac{1}{2}$	43	12·75

* Gross totals include *all cases* not known to be diseased during life, and not *obviously* altered in structure.

† Net totals include *no hearts* amounting to 11 oz. avoirdupois, or upwards.

Note.—All the weights avoirdupois.

Grand total of observations. . { Males 206 / Females 175 } = 381

N. B—The observations made all within the same period, and without selection of cases.

ADVANTAGES OF THE MODE OF TABULATION ADOPTED.

I may be permitted to remark, as to the tables, in explanation of their construction, that I have had a two-fold end in view in arranging the facts in groups, according to age and sex. One reason was this: supposing the sum total of cases, without distinction of sex or age, to be large enough to yield an average pretty nearly approximating to the truth, it might, on arithmetical grounds, be expected that the general average would pretty nearly agree with averages obtained from any large sections into which the general total might be divided, and that any excess or defect in any sectional average, as compared with the general average, would be found to be compensated for by an opposite error in some other section. And the division into sections, without diminishing the facility of obtaining a general average, promised this important additional advantage; that it would enable me to detect any marked deviation from the general average that might be produced by differences of age or sex. Accordingly, both these advantages have been obtained by the mode of tabulation adopted.

Our absolute average weight, then, exclusive of phthisis and morbus cordis, for the adult, is, for the male 9 oz.. and for the female nearly an ounce less, by this first and simplest method of attempting to define the limits of health, viz. totaling up the separate measurements, and dividing by the number of hearts measured, and assuming the quotient as the normal average weight or measure.

NORMAL RELATIVE WEIGHT OF THE HEART.

But is seemed desirable to obtain not only the absolute average weight of the heart, but also the ratio of its weight to those of other organs, and to that of the person. This has been attempted by several naturalists for the brain, and quite recently again, by an illustrious German physiologist, and with some success; and though the peculiar dignity of the cerebral functions would give importance to any even partially successful attempt to elucidate their laws and causation, yet it appeared that the example of Tiedemann might, with advantage, be followed with respect to the heart also; and the attempt has accordingly been made.

RATIO OF HEART TO LUNG.

Amongst the other viscera, the lungs have been selected as the most intimately connected with the heart in function, and at the same time is, if the heart be not an exception, the most important instrument of the organic life. However, of all the organs, the spleen not excepted, the lungs are most variable in volume and density, and of course in weight, so that for want, unquestionably, of sufficient repetition, the success of this method of defining the limits of health in the heart has not yet been such as I should wish.

However, the results are as follows, dividing the cases into three

classes as before, viz.—1. Varia, or various diseases, exclusive of phthisis and morbus cordis; 2, phthisis; and 3, morbus cordis; we have, as average ratios for the whole of life above fifteen years, the following:—

For the first class we have,—

For the male, the ratio of . . .	: : 1 : 5·28, and
For the female, ...	: : 1 : 4·18

For the second class we have,—

For the male, the ratio of . . .	: : 1 : 7·19, and
For the female, ...	: : 1 : 4·60

For the third class, or morbus cordis, we have,—

For the males, ...	: : 1 : 3·79, and
For the females, ...	: : 1 : 3·06

And for all the three classes, viz.—1, varia, or various diseases, excluding consumption and disease of the heart; 2, phthisis; and 3, morbus cordis, we have the general average,

For the male, ...	: : 1 : 5·42, and
For the female, ...	: : 1 : 3·95

Now, if the normal weight of the lungs were known, it would seem that the knowledge of such ratios, supposing them correct, would help us in practice to determine the normality or abnormality of the heart's nutrition or dimensions; and if the ratios between the organs under consideration were deduced from a sufficiently large number of instances, it would certainly be available for that purpose. But for that end a very large number of observations indeed would be required, much larger than are at present at my disposal.

NORMAL RATIO OF THE HEART TO THE WHOLE PERSON AFTER DEATH.

To proceed, then, to the other mode of fixing the normal dimensions of the heart by *relative* measurement; the necessity of this method, in addition to ascertaining the *absolute* weight, is obvious from several considerations, but especially from this, that the heart varies in size, not strictly proportionally to, but still varies with the temperament, sex, stature, and conformation. The stature, especially, is well known to affect the dimensions of the heart, so that, excluding mere fat, a large person always implies a large heart, and, *vice versâ*, a slender person, *cæteris paribus*, a small heart; and to remove this source of doubt, there was no remedy but ascertaining the weights of both heart and person in a large number of cases of persons dead of known diseases. This attempt has been made, and the ratio ascertained as accurately as nearly two hundred observations would furnish the necessary data. These results are contained in the second table, or table exhibiting the ratio between the heart and person in one hundred and ninety-four observations, distinguishing sex and age, and distinguishing other diseases from phthisis and morbus cordis, and these latter also from each other.

TABLE II.

Table of Ratios of Hearts and Persons in 194 cases, viz. 108 males, and 86 females, giving number of observations, and distinguishing sexes, ages, and diseases, as in Table I.

	15 to 30			30 to 50			50 to 70			70 to 100		
	No. of Obs.	Ratio of Heart to Person.		No. of Obs.	Ratio.		No. of Obs.	Ratio.		No. of Obs.	Ratio.	
		Hea.	Per.		Hea.	Per.		Hea.	Per.		Hea.	Per.
Male. Varia,	9	1	to 164	8	1	to 150	18	1	to 161	7	1	to 155
Male. Phthisis,	6	1	160	11	1	146	8	1	154	3	1	136
Male. Morb. cordis,	3	1	115	11	1	121	20	1	119	4	1	124
Female. Varia,	17	1	169	13	1	161	22	1	147	6	1	121
Female. Phthisis,	6	1	162	2	1	199	4	1	150			
Female. Morb. cordis.	3	1	100	3	1	107	7	1	134	3	1	115

	Totals of Obs.	Averages for Life
Male.		
Varia,	42	1 to 158
Phthisis,	28	1 149
Morbus cordis,	38	1 120
Female.		
Varia,	58	1 149
Phthisis,	12	1 170
Morbus cordis,	16	1 114
Averages for life for all diseases, and both sexes, and all ages,		Males, 1 to 142 Females, 1 to 144¼

According to this table, the ratio for all diseases, exclusive of phthisis and morbus cordis, is, for males,

From 15 to 30 years of age :: 1 : 164
" 30 to 50 :: 1 : 150
" 50 to 70 :: 1 : 161
" 70, and upwards :: 1 : 155

For females in like manner, the ratios of healthy hearts to their persons are,

From 15 to 30 years of age :: 1 : 169
" 30 to 50 :: 1 : 161
" 50 to 70 :: 1 : 147
" 70 and upwards :: 1 : 121

And the general averages for each sex of this class, or healthy hearts are, for life, above 15 years, for males :: 1 : 158, and for females :: 1 : 149.

Now the accuracy of these approximations to the true ratios has been tested, amongst other methods, by comparing them with the ratios deduced from two other classes of cases; one remarkable for the nearly uniform increase of weight on the side of the heart; and the other equally remarkable, in general opinion, for invariable loss of substance and diminution of weight and bulk in the person. I mean, of course, morbus cordis and phthisis; and the discrepan-

cies between the results are just such, I think, as I should expect, assuming the ratios found for the normal heart to be nearly correct. They are as follows:—In every one of the four intervals of age, on the male side, we find the heart bear a smaller proportion to the person in the class *Varia*, or that of normal hearts, than in either of the others; while in the class *Morbus Cordis* we find, as might be anticipated, the ratio of the heart to the person greater than in any of the others, and the class *Phthisis* occupies, in this respect, a middle place, the heart in that class being larger with respect to the person than in the class *Varia*, and less very much than in the class *Morbus Cordis*. In the class Varia, the male heart constituted 1-158th of the person; in the class Phthisis, 1-149th, and in the class Morbus Cordis, 1-120th. In the female division, again, the ratio is most favourable to the heart in Morbus Cordis, and least favourable in the class Varia; while at least in the first column which contains the largest number of observations, the class Phthisis occupies, as with the males, the middle place in the ratio of the heart to the person.

Before concluding the subject of the ratio of the heart to the person, let me add the following fact in confirmation of the approximative correctness of the ratios stated as obtained in the case of adults. I have had opportunity of ascertaining the absolute and relative weights of the heart and person in twenty-three cases of persons under puberty; the majority under 5 years of age, and nearly equally divided between the sexes, and I find the average for the males to be :: 1 : 146, and for the females :: 1 : 153, and the common average ratios :: 1 : 149. Now, if we consider the greater activity of the heart in early life, we shall see at once a final cause or reason why the heart should bear a higher ratio to the person than in adult life; accordingly in infancy the organ is relatively weightier than afterwards, until decrepitude; and for two especial causes, viz. first, that it is rather thicker comparatively, in its walls, especially on the right side; and, secondly, that it is all muscle, and contains no fat whatever. The ratio of 1-150th part of the person may be considered, therefore, as an agreement with the post-mortem ratio for adults of ordinary stature and corpulency, as close as could reasonably be looked for, and a confirmation of no small weight of the approximative accuracy of that ratio.

Let me add, that this ratio differs materially from that given in Meckel's Handbuch, which is, :: 1 : 200 for the adult, and :: 1 : 120 for infants and children; but Meckel has not given particular observations, nor, indeed, particulars of any kind, except those just quoted, and probably had not at his disposal a sufficient number of measurements; and further, very possibly paid insufficient attention to differences of sex, age, disease, &c.

NORMAL BULK OF THE HEART.

Then as to the results of measurement by bulk. My observations under this head amount to somewhere about fifty, including

all ages and diseases, and both sexes; and are only so few from finding the difference between the measurements in air (weight) and water (bulk), at all ages, in all diseases, and in both sexes, so inconsiderable that, even in the largest hearts, the former scarcely ever fell more than an ounce short of the latter; so that in every case the weight in air could be inferred from the bulk in ounces of water, and the bulk from the weight, to within a few drams at the most, with much confidence.

DENSITY.

With respect to the density, likewise, it may be anticipated, from what I have just said, that though I have found considerable differences between individuals, yet there has been no constant difference between any two classes. The density was examined by two different methods; the one easier, but rather less accurate, perhaps —viz., by comparing the weight in air with the bulk in minims of water, by means of a graduated vessel; the other by the usual method of obtaining specific weights. The results obtained by those two methods agree in the general conclusions to which they lead; for though they differ from each other in every case, yet the excess is always on the same side, and of the same proportional amount, viz. about two per cent. By the former method, the density varied from 1050 to 1062; by the latter, the limits of variation 1030 and 1040.5; and in neither case was any striking difference detected in connection with morbus cordis, as compared with other diseases. From both sets of observations made by different methods, and on different subjects, and agreeing in placing the density of the normal heart rather above than below that of the diseased heart, it would seem to follow that the predominant tendency in excessive nutrition of the heart is to what may be called eccentric development; that its tissues grow in bulk rather than in density; and that the diseased heart is ordinarily more voluminous for its weight, and less solid for its consistency, than the normal heart. But additional observations are still necessary to warrant a confident opinion on the subject; of this I am fully aware, and it is my intention to repeat my trials as opportunity shall offer; but I am disposed to think that they are not extremely wide of the true proportions.

SUMMARY.

The normal heart, then, to sum up the whole of my observations together, may be assumed to average, for the whole of life above puberty, about 9 oz. in absolute weight, and 8½ in bulk, for the male, and 8 oz. or a little more in weight, and 7½ oz. or a little more in bulk, for the female; and to bear after death to the person, for the male, the rates of about 1 to 160; and for the female, of about 1 to 150. So that a male adult heart, considerably exceeding 9 oz. in weight, but not considerably exceeding the 160th part of the whole subject, might, for a person of the working classes, and of ordinary fatness but of much muscularity, be held to be

normal; while a heart of like absolute dimensions, but occurring in a subject of average stature and muscularity, would justly be considered hypertrophous, although, owing to general obesity or œdema, it should not exceed, or should even fall short of, the 160th part of the weight of the person. And this observation applies, *mutatis mutandis*, to the female; in whom, I think, the extremes of obesity and leanness more frequently occur than in the male; with respect to whom, therefore, this qualification of our rule of measurement is even more necessary than with regard to the other sex. The female stature and muscular developements vary considerably less than the male, and the limits of normal nutrition and volume of the heart are consequently narrower; so that any female heart greatly exceeding 8 oz. in weight or volume, may *ipso facto* be suspected of hypertrophy, whatever may be its apparent anatomical condition; and but few instances indeed, if any, will be met with, I apprehend, of female hearts exceeding 9 oz. in volume, or 9½ in weight, in the persons of individuals of ordinary stature and conformation, that had been quite free from pectoral disease during their lives.

INFLUENCE OF AGE ON THE DEVELOPMENT OF THE HEART.

In the course of some observations upon the mode of construction used in the table of the heart, one advantage expected from the plan adopted was stated to be, that it would render evident, without special search, any difference in the nutrition and development of the organ that might depend on age or sex. In fact, in examining my papers, in preparing the communication above alluded to, as read before the Royal Medical and Chirurgical Society last year, I found reason to conclude that the heart increased in weight and volume with increase of years; and this conclusion was stated to the meeting before which the paper was read. From the first volume of the Transactions of the Medical Society of Observation of Paris, it appeared that Dr. Bizot, then of Paris, had previously arrived at that conclusion by a method quite different from mine, viz., by linear measurement alone. Dr. Bizot's conclusions were founded on a total of observations of one hundred and fifty, or more, and mine on a total of rather less; but the agreement in result, of two enquirers proceeding by methods so different, was striking, and their common conclusion resting on two different and independent lines of evidence and sets of observations, laid claim to a high degree of probability. However, in the numerical method, at least, if not in all methods of interrogating nature, multiplication of instances is every thing; and when preparing these lectures, I of course endeavoured to turn to account the additional observations then at my disposal, for the confirmation of that conclusion if true, or its correction if erroneous. The result is, I think, decidedly in favour of Dr. Bizot's conclusion and my own, of which my readers will now be able to judge.

THE FORCE OF NUTRITION IN THE HEART INCREASES AS LIFE ADVANCES, PROVED BY INCREASING AVERAGE WEIGHT.

It has been already stated, in the account of the first table, that the average for the years 15 to 30, in the male was $8\frac{1}{2}$ oz. in weight; for the years 30 to 50, the net average was still $8\frac{1}{2}$ oz.; from 50 to 70, the net average rose to $9\frac{1}{2}$ oz.; and above 70, to $9\frac{3}{4}$ oz. For the female the following averages were obtained:—15 to 30 years, $8\frac{1}{4}$ oz. 30 to 50, $8\frac{1}{2}$; 50 to 70, 8 nearly; 70 and upwards, 8.

Now in both sexes there is an increase, though not of equal amount. The absolute increase of weight in the male heart, from puberty to extreme age, is near 13 per cent., or about one eighth. In the female there would appear to be, after 50 years, no absolute increase, but rather a diminution; not amounting, however, to more than about 4 per cent.: so that the tendency to increase is not apparent, judging by the absolute weight, except in the male sex. But if we take the table of hearts and persons, and examine the ratios at different ages, we shall find the female heart at least relatively increasing, from the first interval of age up to the end of life. The ratio of the heart to the person, is, in the female between 15 and 30 years of age, :: 1 : 169; in the next interval, it has changed to :: 1 : 161; in the third interval, it has advanced to :: 1 : 147; in the fourth interval of extreme age, it has attained to the ratio of :: 1 : 121. Whereas, in the male, in whom, judging by the absolute weight, the increase with years was obvious, there is, in the table of hearts and persons, a much less striking and regular gradation and increase. The ratio for the first interval is, for the male, :: 1 : 164; the ratio for the second interval is, :: 1 : 150; for the third we have :: 1 : 161; and in extreme age, the ratio :: 1 : 155. For the female, therefore, there is on the whole of life above 15 years, an increase of the ratio borne by the heart of nearly 29 per cent.; so that on the whole, the tendency in the nutrient force to sustain itself in the heart of the female, amid general wasting, and to increase its efforts in that of the male with advance of years, seems clearly evinced by the facts stated, and the conclusion at which Dr. Bizot arrived by the method of linear measurement, is again confirmed by the results I have obtained by weighing the heart.

PROVED LIKEWISE BY INCREASED FREQUENCY AND HYPERTROPHY.

Before passing on to the next topic, I would call attention to another fact already cursorily alluded to, and which, when properly understood, strengthens materially, I conceive, the opinion that in the male heart, at least, the nutrient forces are in no degree enfeebled by age, but are rather augmented. It is this. I mentioned two averages derived from different totals and divisors, when speaking of the table of absolute weight of the heart; the one table containing all hearts not obviously morbidly massive and weighty,

and not known, or on strong grounds not believed, to have exhibited, during life, sufficient signs of hypertrophy; the other containing no heart that materially exceeded those limits within which I have constantly found the healthy heart to fall. Having never, that I know of, met with an instance of a heart that had been functionally quite healthy, amounting in weight to 11 oz. even in males of ample size and stature, I have accordingly omitted, in the second or net table, all hearts reaching as high as 11 oz. Acting, then, on this rule, I have been obliged to omit, in the second or net table, altogether twenty-two male hearts. Now whether those larger hearts thus omitted in the net table as probably morbidly hypertrophous, and which had been included, I believe, in the gross total of healthy hearts only from imperfect knowledge of the health of the subjects, and whose excessive nutrition would probably, had opportunity offered, been made clear to me before death;—whether those hearts be considered morbid or not, their excess above the normal average evinces the tendency to augmented nutrition in the male of advancing years. The energy of any power can only be measured by its effects, and I can conceive no better method of measuring the energy of the *nisus nutritivus* in the heart, or any other organ, than by carefully measuring by weight the quantity of assimilated matter appropriated by, and embodied in, its structures. Assuming the correctness of this view, as it appears to me I may reasonably do, and reminding my hearers that hypertrophy is, physiologically speaking, but a modification of healthy nutrition, I think I am warranted in saying that the superior frequency of excessive nutrition in the heart, as compared with other organs, and more especially in advanced life, can only arise from a greater energy of nutrient action than is habitual in, and proper to, that organ; and that from such superior frequency of hypertrophy alone, might with much probability have been inferred, *à priori*, what Bizot's researches and my own seemed to have proved experimentally—viz. the existence in the heart of a nutrient force peculiarly energetic, not declining through age, as in other organs, but sustained throughout life as in the female, and even growing as in the male with years, contrary to the law of nutrition in every other organ, and in the whole person.

And the modification of the law of nutrition just pointed out, I may remark, before passing to the next topic, suggests an additional restriction of the rule by which the presence and amount of hypertrophy should be determined, and requires that in the male, at least, some allowance must be made for the physiological influence of age over the development and mass of the heart; a restriction that may require attention in judging of cases in which the excess of volume or of weight, absolute or relative, is moderate or disputed.

CARDIAC DISEASE USUALLY COMPLICATED WITH OTHER VISCERAL DISEASE; WHENCE A NECESSITY FOR FIXING THE NORMAL DIMENSIONS OF OTHER VISCERA, &C.

Having proceeded a certain length in the collection of facts, with a view to obtain correct estimates for the heart, I found that, to render those estimates fully available in the investigation of cardiac disease, it would be necessary to ascertain the normal dimensions of almost every other viscus. The relations of the heart are universal. As the main-spring, so to speak, of the circulatory apparatus, its action governs more or less the actions of all the vessels connected with it, while, through the intervention of those thousand subordinate channels, it distributes nutriment to every part, and receives from every part effete materials and recrementitious fluids. It is obvious, then, that any important modification of its vital powers and functional actions must be speedily and deeply felt all over the numerous and complicated organs and systems of organs that depend on it for the materials of life; and that in its graver diseases, and such more especially as permanently or frequently and greatly increase or diminish its energies and movements, much derangement might not unreasonably be expected in the condition of some or all the other viscera. And that this expectation is well founded, will presently be put in evidence. Meanwhile it may be allowable to glance at one or two other reasons for extending the enquiry, by weighing and otherwise measuring, to other viscera, besides the heart.

One reason is, that such an enquiry would possess physiological interest in so far as it would lead to show how far organic development is modified by sex, stature, race, age, and other influences, and strictly compatible with health. Another reason is, the advantage in pathological enquiries of having a standard by which to distinguish between atrophy and hypertrophy, to both of which every organ is subject, and the intermediate condition of normal nutrition. With respect to the former, or physiological uses of such an enquiry, it may be said that it naturally and necessarily precedes the solution, even partial, of several questions of the higher physiology. It is obvious that over and above the mechanical and chemical elements and forces, there are in the living organism vital or hyper-organic powers; and before the share of causation properly attributable to those latter and more subtle causes can be even approximatively determined, it seems plain that the extent to which that most complex condition or phenomenon, Animal Life, is effectuated by the material elements, as mechanical and chemical agents, must first be ascertained; and one of the first amongst the latter enquiries would necessarily be the determining of the law of organic nutrition and development.

Accordingly, the practice of measuring, of which some of the principal results with regard to the heart, lungs, and person, have

been already stated, was extended to the other viscera; and for a considerable period of time, in fact for some years, I have availed myself of every opportunity of collecting measurements by weight and otherwise of all the viscera, of the cranium, abdomen, and pelvis—a search in which I have been indebted to various friends for much valuable and obliging assistance; and of these trials I now proceed to examine the results.

The individual observations have been merged, as before, for convenience, in tables of totals and averages, and the normal average for each sex, and for four intervals of age for each of the following organs, are therein given—viz., the encephalon, the cerebellum, the liver, the stomach, the spleen, the pancreas, and the kidneys.

Weight of the encephalon and cerebellum, according to sex, age, and disease.—To begin with the encephalon. In order to ascertain the normal weight of that organ, or system of organs, I ascertained carefully the weight of between 220 and 230 encephala of persons dead of known diseases above fifteen years of age, and equally divided between the sexes. In 188 cases the cerebellum was examined apart from the whole encephalon, and in 34—viz. 8 males, averaging 45¼, and 26 females, averaging 43¼, no separate measurement of the cerebella was made; 140 of the 222 cases were examples of various diseases, exclusive of phthisis and morbus cordis; and of those 140, half were males, and half females. The whole of the first 188 were then arranged tabularly in four columns as before, for the remainder of life above puberty or fifteen years, distinguishing the sexes, and classing separately also the cases of phthisis and those of morbus cordis, and distinguishing likewise the encephalon and cerebellum, and the following are the results.

The two classes *varia*, in which, for reasons to be presently stated, are included no cases of phthisis or morbus cordis, gave the following averages, viz:—

	Enceph.	Cerebel	Enceph.	Cerebel.	Enceph.	Cerebel.	Enceph.	Cerebel.
Males . . .	49.33	5.5	43.5*	5	45.80	4.80	47	4.80
Females . .	42.17	4.75	42.60	4.25	42.75	4.5	39.90	4
Ages . . .	15 to 30		30 to 50		50 to 70		70 to 100	

* Including three idiots, averaging for the encephalon less considerably than 40 oz.

And the average for each sex for life above puberty are, for the male encephalon 45½ oz., and for the females 42 oz.; and for the cerebellum the averages are, for the male 5.02 oz., and for the female 4.5. Now these estimates of the encephalon differ very materially from the only estimates I know that have been founded on extensive and accurate observation; viz. from those of Sir William Hamilton, of Professor Tiedemann, and of Dr. Sims. Sir William's average for the adult male is 48¾ oz. avoirdupois, and for the female 44 oz. Dr. Sims's average, deducible from his very

valuable table of weights of the encephalon, in the 19th vol. T.R. M.C.S.L., is for the male, from puberty upwards to extreme age, 46¼ oz. avoirdupois, and for the female 43¼ oz. avoirdupois; while Professor Tiedemann's estimate is highest of all, being, according to my calculations, 53¼ oz. avoirdupois for the male, and for the female 44¾.

Table of Estimates of Encephala Averages for the whole of Life above Puberty.

		Male.	Female.	
		Gross.		
Tiedemann . .		53.25	44.75	No apparent distinction of disease.
		Gross.		
Sir W. Hamilton		48.25	44	No distinction of disease.
		Gross.		
Dr. Sims . . .		46.26	43.25	No distinction of disease.
		Net.		
1. J. C.		45.50	42	Phthisis and Morb. Cor. *excluded.*
		Gross.		
2. J. C.	104 m. / 84 fe. — 188	46.17	42.11	Phthisis and Morb. Cor. *included.*
3. J. C.	24 m. / 10 fe. — 34	45.75	43.25	Phthisis alone.
4. J. C.	33 m. / 15 fe. — 48	47.25	43.60	Morbus Cordis.
		Net.		
5. J. C. (cerebellum)		5.02	4.50	Phthisis and Morb. Cor. *excluded.*
		Gross.		
6. J. C. (cerebellum)		5.17	4.69	Phthisis and Morb. Cor. *included.*

The greatest difference is, of course, between the extremes of the scales of estimates, which are on the male side greatest, viz., between Tiedemann's and mine, and amount to nearly half a pound avoirdupois, or one sixth of the whole. Sir William Hamilton's estimate falls short of Professor Tiedemann's by five ounces, or near one third of a pound, and differs from mine by about one fifteenth. Dr. Sims's is something more than seven ounces, or 44-100ths of a pound lower than Tiedemann's, and exceeds my estimate by three quarters of an ounce. Then, on the female side, Tiedemann is nearly one sixth of a pound higher than my estimate; Sir W. Hamilton two ounces higher; and Dr. Sims about one ounce and a quarter higher than my average estimate. Now those differences are considerable. Professor Tiedemann and Sir William Hamilton, in particular, have obtained averages very greatly in excess, or else my averages, and I may add those of Dr. Sims also, err very seriously in defect.

Estimates differ, and why?—In explanation of those differences the following facts and considerations present themselves. First, with regard to the number of observations from which each has drawn his averages, it appears that Tiedemann possessed but fifty-two direct observations, including all ages and both sexes, and exclusive of negroes. The amount of Sir William Hamilton's direct observations appears to have been from sixty to seventy, including

both sexes and all ages; while Dr. Sims has given nearly 220 observations of subjects above puberty, and I myself a number of cases, above fifteen years, somewhat greater than that of Dr. Sims.

Now if the averages obtained from Dr. Sims's observations, without distinction of disease, and from my own, without excluding phthisis and morbus cordis, be summed up and halved, averages will thus be obtained drawn from about 450 observations, including both sexes, viz., for the male, 46.58 ounces; and for the female, 42.68 ounces,—averages not very considerably different from my own, and founded on a total of observations nearly eight times as numerous as either of the totals of Professor Tiedeman nor Sir William Hamilton; so that there is much reason, on the ground of superior extent of observation, to conclude that my estimate approaches very much nearer the true one than either of Professor Tiedemann or Sir William Hamilton. Then with respect to the difference between the results of Dr. Sims's observations and mine, there is a circumstance not belonging to this place, but to be enlarged on hereafter, that seems fully to explain that comparatively small difference.

In deducing their averages, distinction has not been made on the part of Professor Tiedemann, Sir William Hamilton, or Dr. Sims, as it has been for my own estimates, of the cause of death; and to this difference in the mode of investigating the matter, it appears to me may, with much probability, be attributed great part of the difference between the results to which our observations respectively lead; and, indeed, all the difference between Dr. Sims's average and mine. With respect to this cause of the difference between the results so often referred to, it will be sufficient at present to state the following averages. My average for various diseases, exclusive of phthisis and morbus cordis, and distinguishing the cerebellum, as already given, is for the whole encephalon 45.5 for the male, and 42 for the female; and if to those averages we add respectively the averages obtained from thirty-four other cases of various diseases, exclusive of P. and M. C., and of either sex, and in which no separate measurement was taken for the cerebellum—(viz. 45.25 for the male, and 43.25 for the female)—if we add those to the former and divide, we shall have from the whole 174 encephala the following averages—viz., for the male 45.37, and for the female 42.62; averages differing little from the standard, being 13-100ths less for the male, and nearly 66-100ths more for the female. So far, therefore, the enlargement of the basis of calculation increases the probability that the first results were near the truth, since 174 observations give in each sex, within a fraction, the same averages as the original dividend of 140. But the supposition that the difference between the estimate deducible from Dr. Sims's series of observations and mine, is owing to want of distinction of diseases which I have not attempted in summing up his weights for averages, seems to me clear, from this especially, that I find, as I shall hereafter state at length, that increase of weight is, in the encephalon,

an usual effect or concomitant of morbus cordis; that my averages for morbis corbis alone exceed those deduced from Dr. Sims's table for all diseases, and that my *gross* averages for all diseases are higher considerably than my *net* averages for various diseases, exclusive of phthisis and morbus cordis; the latter or *net* being, as already just stated, 45.37 for the male, and 42.62 for the female; whereas my averages, without distinction of disease, are, for the male 46.17, and for the female 42.95 (or nearly 43); and in each sex, therefore, very considerably higher than for the select class *varia*. But as I shall have occasion to return to this subject, I shall at present content myself by assuming the average for the brain, or encephalon, to be 45.37; or 45¼ for the male, and 42.62, or 42⅝ for the female.

Cerebellum.—With respect to the cerebellum, of which, as not noticed separately from the brain or encephalon by Professor Tiedemann, or Dr. Sims, the average absolute weight for the males, excluding morbus cordis and phthisis, is, from 15 years upwards, 5 oz. and 2-100ths; and for the females, with like distinctions, 4 oz. and 5-10ths. This ratio between the sexes, of : : 10.9, is considerably different from that apparently found by Sir William Hamilton, whose statement is, that the cerebella of the sexes are nearly equal in absolute weight, but that the female cerebellum is rather the heavier. But he makes no mention of the absolute weight of the cerebellum, nor of the number of observations precisely, from which his conclusions are drawn.

Now, since the number of observations on which my conclusions are founded is at least three times as large as those at his disposal, on that account I think it not unreasonable to infer that he was misled by paucity of facts, and that he has either overrated the female, or underrated the male, so as to have obtained a ratio very different from the true one.[1]

Density of the brain, &c.—In another statement, however, of Sir W. Hamilton, I fully concur; I mean with regard to the density of the encephalon. Like him I have found little difference between the different parts of the encephalon; with this exception, however, that the density of the cerebellum usually exceeded considerably, as he also has remarked, that of the cerebrum.

In more than fifty observations at all ages, of both sexes, and of various diseases, I have met with but two or three instances in which the cerebrum exceeded or equaled in density the cerebellum. The average cerebral density for the males, I found by the first method (above described) to be 1056, to water as 1000; and for the females 1045; whereas in the cerebellum I found the proportions reversed, the male cerebellum being less dense than the female, the former being 1060.5, and the latter 1064.5. By the second method I obtained the following:—

[1] I regret that while writing those observations on the cerebellum, I had not an opportunity of perusing Mr. Combe's recent work.

For the male brain	1031.33
For the male cerebellum	1037.25
For the female brain	1035.87
For the female cerebellum	1038.35

so that by this method, also, the female would seem to exceed in the density of the cerebellum; and in both sexes the cerebellum would appear to be denser than the cerebrum. Like Sir W. Hamilton, I have found as yet, by either method, no striking influence of age upon the density of the encephalon; one of the densest encephala I have met with having been that of a female eight years old, found dead in bed; and one of the least dense, that of a male of fifteen, dead of phthisis, a disease in which I usually find the encephalon amply developed. On the whole, it seems clear that the tendency to variation in nutrition and development in the encephalon is not eccentric only, as in the heart it would seem to be, but is also often concentric and condensing in its effects: a difference between the organs, owing probably to this—that the brain is not subject to the distensive forces that affect the heart's parietes, viz. the expansive efforts of the diastole, and the reaction of the fluids in the systole. The liability of the encephalon to abnormal condensation is well shown by the following recent observation:—A woman of seventy died of apoplexy, after an illness of some weeks. One hemisphere of the brain was observed to be normal, the other to be smooth and dry, with flattened convolutions. Under the floor of the ventricle, on the same side with the flattened convolutions, was a large clot that had burst into the ventricle, and pressed up the hemisphere apparently against the calvarium. The normal hemisphere, in this case, was found to be 1034.5, specific gravity: whereas the compressed hemisphere was 1338.5, showing an unequivocal cerebral condensation on the compressed side.

LUNGS AND ABDOMINAL VISCERA IN THE NORMAL STATE.

We next proceed to the lungs, and I am quite sensible of the difficulty of dealing with these organs in the same way as with the other. I have already alluded to the fact familiar to anatomists, viz., the unparalleled variability in density, volume, and absolute weight of those viscera. If it be attempted to bring them in some degree out of the field of mere empirical opinion, in which, in great part, they at present lie, into that of science, by the application to them of tests and processes, open to every understanding, whether *technically* instructed or not, we find ourselves immediately involved in opposite difficulties. If we choose density for our standard, we are at once embarrassed by similarity of results, with extreme diversity of organic conditions. The phthisical lung, the pleuro-pneumonic, the œdematous, and the extremely congested lung, will frequently exhibit like specific gravities, like densities, even in spite of considerable pains in preparation. If we take volume for our test, we are little better off than with density, for the œdema-

tous, the emphysematous, and the extensively tuberculated lung, and the lungs that have been extensively tumefied and consolidated by pneumonia, will often possess the same volume. Linear measurement is obviously open to all the objections almost already noted, or alluded to, and to some peculiar to itself; and weighing is, with respect to the lungs, exposed to sources of fallacy probably as numerous as any other mode of measurement. There are therefore great difficulties in the way of any attempt to bring within the pale of physical investigation, all or any part of the pathology of the lungs, above probably all the other organs. Yet the necessity of some precise knowledge of those physical characters of the normal lung, that admit of instrumental measurement, is clear; witness the writings of Ploucquet and others, on the *docimasia pulmonum hydrostatica.* This has been long felt in forensic practice, and in practical pathology it appears to me to be as desirable as any other branch of scientific medicine. With these feelings the lungs have been for some time included in the measurements by weight, already a considerable number of observations (130 to 140) have been collected, falling short, however, very much of a total capable of yielding trust-worthy results. Those observations, arranged according to age, sex, and disease, as the tables of hearts and encephala, give for the lungs the following results:—The class *varia* gives, as the average for life above fifteen, for the male, 46½ ounces, and for the female, 35½ ounces; the number of observations amounting to 31 for the males, and 34 for the females. These estimates are much less than those of Meckel, which are for both sexes apparently about 55 ounces.

Abdominal viscera.—With respect to the abdominal viscera, I shall now state shortly the number of observations, and the averages I have obtained for the whole of life above fifteen; and for each of them, in from 150 to 160 subjects, two thirds of whom nearly were females, and none of whom had phthisis or morbus cordis, nor any obvious morbid appearance of the viscera, implying unusual weight or density.

Table of Weights of the Abdominal Viscera for Life above Fifteen Years of Age, and excluding Phthisis and Morbus Cordis.

	Weights Avoirdupois.		Number of Observations.	
	Males.	Females.	Males.	Females.
Liver	49. nearly.	44.5	55	101
Spleen	4.75	4.33	50	93
Stomach	4.5	4.40	34	51
Kidneys	8.33	8.	55	98
Pancreas	2.25	2.25	51	84
Lungs	46.5	35.5	31	34

From the table it appears that this average weight of the normal liver may for the adult male be assumed to be about 3 lbs. avoirdupois, or a little more, and for the adult female about a quarter of a pound less, or 2¾ lbs.

The spleen appears to weigh, on the average, between 4 and 5 ounces, being in the table 4¾ for the adult male, and for the female 4½ ounces avoirdupois. The stomach would seem to weigh the same in either sex nearly—viz. about 4½ ounces. The kidneys average, for the adult male, something under 8½ oz., or in the table 8⅓ oz.; and for the female, the average appears pretty accurately to equal 8 oz.; and the pancreas seems of the same weight in either sex—viz. about 2¼ oz. Now the totals from which these averages have been deduced, are, for the liver, between 150 and 160, observations of which nearly two thirds were females. The spleen was examined in between 140 and 150 instances, and nearly two thirds were females. The stomach was weighed in from 80 to 90 cases, in which nearly three fifths were females. The kidneys in from 150 to 160 cases, of which something more than one third was male, and the pancreas in from 130 to 140 instances, of which a considerable majority was female. These totals are too considerable, it is imagined, not to yield averages approaching the truth pretty nearly. From these totals every case of unequivocal and obvious abdominal visceral hypertrophy, and morbid excess of whatever kind, were carefully excluded, as were all cases also whatsoever in which the lungs were phthisical, or the heart diseased.

By such sifting, the totals have been in several instances reduced to half the amount, and less, they would otherwise have reached; but the ends in view, viz. true averages, have, it is conceived, been more advanced by the selection of healthy viscera, than impeded by the diminution of the totals to be divided.

These numbers differ considerably from the averages of Meckel, which are, for the liver for both sexes and adult life, about 3½ lbs. avoirdupois: for the spleen of adults of both sexes about half a pound: for the kidneys for both sexes about a quarter of a pound each, or about half a pound for both kidneys; and for the pancreas, something between 4½ and 6½ oz.

These estimates of the great anatomist, and accurate and excellent writer, Meckel, are however deduced from totals of which the amount is not stated, and in which there is further no statement of any adequate precautions having been taken to distinguish modifications of development produced by age, sex, disease, &c. I feel myself, therefore, at liberty to question the accuracy of the estimates of Meckel, where they differ much from my own, and to say that considering the number of observations, and the care taken in classification and selection on my part, there is reason to prefer my estimates to his, as approximations coming much nearer the truth. Respecting one organ only are we agreed, viz. the kidneys, regarding which our respective estimates are nearly identical. For all the

other viscera his averages are much too high. With respect to density, also, the results I have obtained seem to differ considerably from those announced by Professor Meckel. Density and specific gravity would seem practically to mean nearly the same. Density, to which I have principally directed my attention, signifying the quantity of matter in a given bulk of any substance under observation; and specific gravity, the gravitating force exerted by a known bulk of such substance in comparison with some other. The specific gravity and the density must be mutually proportionate, therefore, to each other. Meckel, however, announces the specific gravity of the liver to be 1500 and that of the spleen 1200, if I rightly guess, for there is some typical ambiguity in the text; and I have repeatedly found the liver to differ in weight from its own bulk of water by about 1-20th, and never, that I know of, in numerous trials, more than one 1-15th or 1-16th; which would give a density considerably under 1100, compared to water as 1000, and a specific weight still lower;—and I have as much reason to doubt the accuracy of his estimates of the specific gravity of the spleen as of the liver.

Having thus stated what I have judged necessary for my object, with regard to the physical characters of the viscera in their normal condition it becomes my duty to enter upon the second branch of my subject, or the abnormal conditions of the organs, in so far that it is susceptible of instrumental investigation and measurement, and in so far as such instrumental examination as has been instituted is calculated to throw any light on the causes and effects, signs and treatment, of cardiac disorders.

When we look at Albertini's work, *De Cordis Palpitationibus*, or Lancisi's work, *De Corde*, the one within the former half of the seventeenth, and the latter within the former half of the eighteenth centuries, and compare their semeiologies or ætiologies with those of any well informed physician of the present day, we at once perceive that great progress has been made since their times, and that more has been done for cardiac pathology within a few dozen recent years, than had been effected through all previous time. But much remains to be done, and the efforts of very many successive as well as cotemporaneous enquirers, working under various circumstances, and with various methods and instruments of investigation, will be required, to raise the science and management of cardiac disease to a degree of perfection equal to that of the least perfect of the physical sciences or mechanical arts.

Disease, as well as health, has many and various attributes and aspects, which are not all to be examined successfully by any one method, or test, or instrument. Of the means of which the pathologist may usefully avail himself, some are strictly anatomical and physiological, but these are not all; the instruments in use in

physical enquiries are many of them available in pathological investigations also. Amongst the rest, the balance is one of which I think too little use has been made, although an instrument that might be supposed to be of some utility, and is certainly of comparatively easy application. It is now some time since I first satisfied myself of its utility in observation, and of the extreme difficulty of accurate pathological investigation in numerous cases with the unaided touch and sight, and of the necessity of adding to our other means of examination, in certain organic diseases more especially, the mechanical means just named, for the purpose of correctly estimating the effects of disease upon the viscera, in influencing the mode and degree of their nutrition. The College will judge how far I have reasoned correctly, or have been deceived on the subject. I now proceed to state the results of my observations.

DEVELOPMENT, &c. OF THE DISEASED HEART.

The heart itself, of course, claims the first notice. Since I began to employ the balance, &c. in post mortem examinations, I have had opportunity of inspecting the remains of from 170 to 180 cardiac subjects, dead of morbus cordis in most instances, of course, but in a considerable number of cases dead of other diseases, of which diseased heart was a cause or else a complication. These are from amongst a much larger number who have come under my notice within a few years, principally in official practice. Of these the majority—the great majority, indeed, but I cannot say the exact proportion—had suffered during life from symptoms by which they could easily be, by any experienced pathologist, recognised as examples of morbus cordis; but several died without its having been known before their deaths that there was any organic affection of the heart involved in their complaints. Some of the latter had been brought in moribund, others had had their cardiac symptoms masked by mania, or by typhus, or by phthisis with delirium, or by spasmodic cholera, or by universal bronchitis with emphysema pulmonum, otherwise vesicular dilatation, with bronchial hypertrophy; and there were also some examples of violent pleuro-pneumonia in advanced stages, by which morbus cordis was masked, until the cases were hopeless, or even until death. Of the 170 to 180 cases, two thirds almost exactly were males, and one third only females. Thirty were cases of well marked valvular disease, combined with obvious hypertrophy in almost every case; and the remainder, or nearly five sixths, were cases of simple hypertrophy, without pericarditis or endo-carditis, or unequivocal valvular deficiency or disease.

The diagnostication of the hypertrophy was, as is usual, easy in most cases. The unaided touch or sight was often sufficient to show that the volume and weight of the organs, and thickness of their walls, were abnormal. Where decided valvular deficiency or disease existed, of course the evidence of morbus cordis was

obvious. But in none of the cases could *the degree* of hypertrophy be correctly estimated without measurement, whether linear, or by volume, or by weight. In a very considerable proportion of them no observer could, without such aid, affirm that the excess of weight or volume was slight, considerable, or extreme, upon any better or less equivocal ground than his own private conviction; and in several cases in which considerable hypertrophy existed, the heart being found to weigh 11 to 12 oz. or more, in persons of common size, it was at first conceived, *judging by the touch and sight*, that the heart was normal.

One case particularly struck me. It was that of a person whom I had known for some years during life, and who for many years had been short-winded, and what is popularly called asthmatic. This man had had influenza during the last great epidemic, and had not completely recovered, when he over-exerted himself by carrying a weighty parcel, and was immediately attacked with violent dyspnœa, with extreme anxiety, and some pneumonic symptoms, and sank within a week. The heart of this man was pronounced normal by several spectators familiar with pathological anatomy, and appeared to myself much less than from his history I should have expected. When placed in the balance, it was found materially to exceed the limits of health, his size, sex, age, and every other circumstance duly considered. It weighed $11\frac{1}{4}$ ounces avoirdupois, and was, of course, in bulk as measured in water, some drams less.

In nearly all the cases there was more or less hypertrophy, often on both sides, but almost always in the left ventricle at least. The exceptions, amounting to two or three per cent. of the 170-80, were mostly wasted females advanced in life, and dead of valvular disease. The average weight of about eighty male hearts, taken without selection on account of weight, was about 15 ounces avoirdupois, instead of 9 ounces, the normal weight for adults above fifteen years, or an increase of substance of two fifths, or 40 per cent., and the female average on forty to fifty specimens was about 13 ounces, or $38\frac{1}{2}$ per cent. increase, or nearly the same proportional increase as in the male cases. In no instance of morbus cordis, whether including valvular disease or not, have I observed any diminution of the heart in weight or volume below the normal proportions above stated, not even of such as were wasted by phthisis, antiphlogistic remedies, long suffering, &c.

Complications of morbus cordis.—In almost no instance in which the heart was known, during life, to be diseased, or was the subject of just suspicion, do I find that the heart alone was in a morbid state. On the contrary, complication with diseases of other organs was the rule, to which the exceptions bore a very small proportion indeed, limited nearly to cases of persons cut short suddenly by accidents, and mostly of no advanced ages. The complicating diseases were numerous, principally inflammatory, often acute, more frequently chronic; and these complications bore as large a propor-

tion to the uncomplicated cases in the 140-50 instances of simple hypertrophy, very nearly, as in the thirty cases of decided valvular disease. In each class the complications were of the same nature likewise. No marked difference was observed between them, except that, on the whole, there was, during life, more pectoral distress in the class of cases involving valvular disease, and disease of the orifices,—which latter by the way, when real, and not an accident depending on the state of the contractile energy immediately preceding and attending death, usually, I conceive, implies the former or valvular disease. Also, that the tendency to diffused dropsy, including all the cavities nearly, as well as the cellular substance of the lungs and lower extremities, and also the pulmonary vesicles, was greater on the whole in the class Valvular Disease. The particulars of the well-marked complications ascertained post mortem, were as follows;—

Of the cases of simple hypertrophy,

23 had phthisis.
29 — pleuritis.
36 — pneumonia and pleuro-pneumonia.
22 — pericarditis.
6 — mania.
23 — various other diseases; amounting together to 14, viz.

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typhus, delirium tremens, influenza, metritis, peritonitis, cholera, rubeola, morb. cerul., erysipelas, diarrhœa, quotidian, hemorrhages, aneurism, and mors subit. Besides the above 139, fifteen had apoplexy, viz. nine males and six females, out of a total of 34 cases of apoplexy, or nearly three sevenths or 42 per cent. of all the cases of apoplexy examined. Of the remaining four sevenths, six were males, of whose hearts two were not examined, and thirteeen were females, of whom four were doubtful for the same reason.

The general total of complications of morbus cordis was then 154, exclusive of bronchitis, and exclusive also of several instances of morb. chron. cerebri—such as comatose, epileptic, and fatuous cases of long standing; also cases of softening (ramollissement) of the brain in advanced years; none of which are included above. Of the whole number of cases, a small fractional part only were free from chronic bronchial disease, in the shape of bronchial injection and hypertrophy, with vesicular dilatation. A majority had likewise œdema pulmonum, and a large proportion had serous effusions, or dropsy. In five sixths to six sevenths, or between eighty and ninety per cent., there was enlargement of all or several of the viscera; the lungs included, which were generally considerably denser and heavier than normal. In all these respects there was little if any difference between those cases of simple hypertrophy and those other cases in which the valves were implicated.

The following tables give the average weights of the viscera in the classes *Varia* and *Morbus Cordis*, according to the age and sex:

Table of Weight of Viscera according to Age and Sex.

VARIA.

	15 to 30.		30 to 50.		50 to 70.		70 to 100		No. of Obs.	
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
Lungs . . .	38	33½	50	35	56¾	36	41	38¼	31	34
Liver . . .	55	55⅝	49	47	49⅓	40⅜	41⅜	35	55	101
Spleen . . .	5	5	4½	5	4½	4	5	3½	50	93
Stomach . .	5	4⅜	5	4½	4⅓	4.1	4	4⅓	34	51
Kidneys . .	8¼	9⅓	9	8⅜	8½	7½	8	6⅓	55	98
Pancreas . .	3	2⅓	2½	2¼	2⅓	2 1.6	1⅜	2 1.5	51	84
Encephalon .	49.33	42.17	43.5	42.5	45.8	42.75	47	39.9		

Table of Viscera according to Age and Sex.

MORBUS CORDIS.

	MALES.				FEMALES.			
	15 to 30.	30 to 50.	50 to 70.	70 to 100.	15 to 30.	30 to 50.	50 to 70.	70 to 100.
Encephalon	50.75	49.66	47.1	41.5	. .	44.5	45.8	40.5
Cerebellum	4.5	5.5	5.12	4.7	. .	4.75	5.25	4.25
Lungs	47.5	59.	56.5	59.	33.	32.	41.	35.
Liver	66.5	63.25	51.5	48.5	59.	54.	50.25	40.5
Spleen	7.	8.25	5.17	4.33	7.5	5.75	5.5	4.
Stomach	5.25	5.5	5.5	5.5	5.5	5.	4.75	5.33
Kidneys	11.25	11.25	9.5	8.33	10.5	10.	8.5	8.
Pancreas	3.	3.2	3.	3.11	2.5	3.25	2.25	2.38

From these tables, which are founded on totals which are in most cases considerable, and include several scores of separate observations, it would appear that in morbus cordis there is an increase in the volume and weight of every single viscus, as compared with the standard of the class *Varia*, (with the exception of the male cerebellum,) on the whole of life, and in each subdivision of the four in each table—viz. from 15 to 100, and from 15 to 30, 30 to 50, 50 to 70, and 70 to 100. The average, in fact, in nearly every observation is considerably above the standard in the case of every viscus. The encephalon, if we take the first column, or the interval, 15 to 30, gives for the male 50¾ or 3lbs. 2¾ oz. avoirdupois, instead of 49[1], or 3 lbs. 1⅓ oz.; being an excess over the normal dimensions of nearly one thirty-third part. The lungs, in like manner, are found to exceed by about one fifth: the liver by about one eleventh; the spleen by two sevenths; the stomach by one twentieth; the kidneys by about one fourth. Then, in the second column, for the interval 30 to 50, the encephalon exceeds the normal standard by more than one eighth; the lungs by nearly one fifth; the liver by more than one fifth; the spleen by one half; the stomach by more than one twentieth; the kidneys by more than one fifth; and the pancreas by more than one sixth. In the third column the encephalon is less than in the second, as there it was less than in

the first; but it is still one thirty-fifth in excess, at least; while the lungs are about the same weight: but the liver is larger by more than one fifth; the stomach by one fifth; the kidneys by one ninth; the pancreas by one sixth; and so on of the rest. And in every column, in like manner, the female portion of the table gives the same or a similar excess of the viscera above the normal standard; whilst, on both sides of the table, and in the case of every organ, the life averages for morbus cordis exceed those for other diseases not complicated with disease of the heart. The averages for the two classes for life are as follows:—

Encephalon.

	Males.	Females.
Varia,	45.33	42.62
Morbus cordis,	47.25	43.60

	Male Varia.	M. Morb. Cordis.		Fem. Varia.	Fem. Morb. Cordis.
Lungs,	46.5	55.5	Lungs,	35.5	36.
Liver,	49.	57.	Liver,	44.5	50.75
Spleen,	4.75	6.12	Spleen,	4.33	5.5
Stomach,	4.5	5.40	Stomach,	4.40	5.12
Kidneys,	8.33	10.	Kidneys,	8.	9.25
Pancreas,	2.25	3.	Pancreas,	2.25	2.5

Since then, the general averages, and not those only, but also the sub-averages or quotients of the different ages of each sex respectively, differ so decidedly, it seems difficult to avoid the conclusion, that in morbus cordis there is usually a considerable increase of volume and weight in the viscera of all the cavities: and indeed, to judge by my own opportunities, I should say that there cannot be a doubt that the enlargement of several of the abdominal viscera remarked by several authors, and usually referred to congestion of blood in the capillaries, owing to reflux, real or imaginary, from the heart, is a substantive, and not an apparent hypertrophy only. After first observing the frequency of such visceral enlargements, I constantly incised every viscus before weighing it, until I satisfied myself that the conjectural explanation founded on supposed reflux and stasis of the blood, would not meet the facts, and that, in addition to occasional or even frequent and considerable congestion, there must be excess of deposition of assimilated fluids, otherwise excessive nutrition. But latterly the encephalon, heart, lungs, and stomach, have been the only organs uniformly incised; and, saving the heart and stomach, and occasionally the lungs also, I have not observed the weight of any viscus to be materially altered by incision, which, however, they could not fail to be if any considerable portion of their volume or weight depended on congested fluids.

Additional Considerations.—Now as the question, as to whether morbus cordis is ordinarily attended by general visceral enlargement or not, and is itself directly or indirectly either the cause or the effect of such enlargements and hypertrophies or not, is a question of some importance in several respects, it seems fitting that I

should here state any additional facts or considerations that may be at my disposal, in confirmation of the view I take of the subject.

To begin with the encephalon. One fact is this, that of 58 of the 520·30 cases, in which the encephalon weighed 50 oz. and upwards, and of which 53 were males, and 5 females, 33 were known cases of morbus cordis, or more than 61 per cent.; and of six or eight, it is uncertain whether the heart was hypertrophous or not. This coincidence of excessive volume in the brain and heart in so large a proportion of cases, is not easily reconciled with any other supposition than that which I have adopted, viz. that the encephalic augmentation is an effect in some way of the cardiac disease. This conclusion derives partial support from Dr. Sims's paper. Of his cases, 37 were of 50 oz. and upwards of encephalic weight, and of those most had died either of morbus cordis, or dropsy, or apoplexy, or phthisis, or pneumonia, and were, some certainly, others probably, complicated with more or less hypertrophy, more especially of the left ventricle.

Another fact is the connection long since remarked by Albertini, I think, and above exemplified, (p. 595, c. 1), between apoplexy and morbus cordis, and which has been exemplified also, it is said, in the persons of several eminent medical professors: of Malpighi, and, if my memory rightly serves me, of Lancisi, of Corvisart, of Cabanis, of Ramazzini, of Parry, and others; and of many lay persons of consideration; one of our British kings of the Hanoverian line being amongst the number. Sudden arrest of action in an organ naturally of the most delicate susceptibility, when in a plethoric condition, is no more singular than sudden increase of activity. These extreme fluctuations are common in all functions depending essentially on vital properties and dynamic conditions; and seated in organs over stimulated and over nourished. Sudden arrests of the action of the hypertrophous heart is one of the ordinary forms of death in morbus cordis. Syncope, another form of suspended action, or at least diminished action, is another frequent incident in the course of cardiac disease. Assuming, therefore, the hypertrophy of the brain in those individuals, I can easily understand the occurrence of apoplexy. If cerebral pressure be the true cause of apoplexy, or even supposing it the commonest exciting cause only, which appears to me the more reasonable supposition of the two, it is easily understood that a moderate transitory congestion, or sudden afflux of the blood, may, in a too voluminous encephalon, excite an apoplectic seizure. It is likewise very obvious that, to persons advanced in life, as were Malpighi, George the Second, &c., in whom induration and fragility may have commenced in the cerebral arteries, a very moderate accumulation of blood may be attended by cerebral hemorrhage.

Observations of authors.—Then, with regard to the other viscera, it is well known that numerous pathological writers have recorded instances of enlargement of induration, and other morbid changes of several of the viscera, in connection with morbus cor-

dis. With respect to the lungs, for example, Lancisi states, that in his experience aneurism of the aorta (which I find invariably accompanied by hypertrophy of the heart) had often caused suffocation, asthma, hydrothorax, and other pectoral symptoms, commonly referred to other viscera.—(1740, p. 284.) Lancisi also attributes aneurism of the heart to asthma and chronic catarrh, showing thus that he was aware of a connection between pulmonic diseases and morbus cordis. Senac adds, phthisis and pneumonia, (L. 6, C. 8, S. 4.) Corvisart speaks of induration and engorgement of the lungs, attending morbus cordis as an effect of it. (By Hebb., p. 388.) Dr. Bree quotes from Morgagni, and other authors, several cases of asthmatics, whose lungs were found charged with fluids, and which were probably cases of chronic catarrh, with morbus cordis. In several, he mentions the lungs were firm and heavy. In all, the symptoms were those of the bronchitis of advanced years, which, as Andral has well remarked, usually depends on, or is connected with, enlargement of the heart. He remarks, as it were in confirmation of that supposition, that, in his opinion, and those of numerous authors, the spasmodic asthma is more common in males than in females, which is just what must happen if asthma be always dependent on, or connected with, disease of the heart; as, along with Kreyssig and several excellent French pathologists, I believe it to be. Lieutaud gives, in his great collection, numbers of cases of heart disease, certain or probable, in which the lungs were also diseased, viz.—emphysematous, œdematous, inflamed, &c., especially in his second book, sections 2, 5, 6, 7, 9, 12, 14, 15, 16, in each of which cases are given in which the heart appears to have been diseased in connection with grave pulmonary disorder, as adhesions of the lungs, sect. 5—emphysema, sect. 6—infarction, sect. 7—inflammation, sect. 9—pulmones purulenti, sect. 12—ulcus pulmonum, sect. 14—pulmones præduri et schirrosi, sect. 15—pulmones tuberculosi, sect. 16—and in the two following, several cases are given in which cardiac symptoms with pulmonic were mingled during life; and in several of which, though disease of heart is omitted, because probably overlooked, enlargements, indurations, &c. of lungs, liver, spleen, &c. are mentioned. In his second volume, from observations 407 to 441, numerous cases in point are cited. Observations 613 to 652 have most of these pectoral symptoms, cardiac and pulmonic, and many morbid appearances in each organ. The observations 701, 705, 847, 861, present similar combinations of pectoral symptoms and appearances. In like manner, in his chapter "De Colluvie Serosâ," numerous observations illustrate the pathological connection between the two great organs of the organic life; and though the heart is not mentioned in several, yet morbus cordis appears to have existed, and produced visceral indurations, congestions and enlargements. Dr. Hastings has a chapter, in his History of Bronchitis, "On dropsy dependent on bronchitis;" and in his description of the disease, he enumerates "constriction across the chest, as if

by a ligature; violet colour of the lips; lividity of the face; anxiety and uneasiness referred to the heart; palpitations; extension of the heart's action beyond normal limits; pulsation in epigastrio; an undulating motion of the heart during the action of the ventricle; irregularity of the pulse; dulness on percussion on the left thorax;" amongst the symptoms. He adds, that it is common in old people who have had chronic cough for years, and much expectoration; common also in spirit-drinkers in the decline of life; the heart in such cases being generally enlarged, and sometimes adherent. He attributes the enlargement of the heart to extension of disease from the bronchia. Notwithstanding all this equivocal ætiology, there is abundant evidence of a knowledge of pulmonic disease in connection with diseased heart. In the third volume of the Clinique Médicale, we are informed that when chronic bronchitis is accompanied with much oppression, it is in that case complicated with morbus cordis; the disease of the heart being often prior in date, but sometimes being posterior to the bronchitis, and an effect of it and the dyspnœa which it occasions.

Such are some of the principal particulars that I meet with in authors confirmatory of the connection I have represented as nearly constant between pulmonic and chronic cardiac disease. Had the practice of slitting open the bronchia in *post mortem* examinations, with a view to inspect the inner surface of the bronchial ramifications, and to ascertain the condition of the parietes of the air-tubules and air-vesicles, been more common, I cannot doubt that I should readily find much more precise information on the subject of the connection between the lungs and heart in disease.

But the evidences respecting the connection of abdominal visceral enlargements with morbus cordis found scattered over authors, are much more numerous and precise than those that relate to pulmonic complications of morbus cordis.

Lieutand has been already cited as noticing the existence of abdominal visceral enlargements in connection with diseases of the heart: that he does in numberless places, many of which have been already referred to. Senac states, that what he calls "engorgement," by which I understand apparent enlargement and real hypertrophy, is a frequent, though (then) little known consequence of dilatation of the heart. Corvisart points out "engorgement of the liver with tenderness" as an occasional source of error in diagnosis. (an observation I have had myself frequent opportunities of verifying); but the large liver is common in one degree or another in all heart cases, owing, he thinks, to regurgitation. Dr. Bree mentions enlargement of the liver as common in connection with enlarged heart, and as a cause of asthma. Dr. Hastings remarks the connection between the bronchitis of the drunkard and enlargement of the liver, and ascribes the thoracic disorder to the extension of the hepatic irritation to the lungs. But Portal gives the most information respecting the morbific powers of the liver, of such authors as I have had opportunity of consulting. He ascribes the

symptoms of steno-cardia to disease of the liver, including the stricture of the chest, and spasms of the diaphragm, also the numbness of the arms, risus sardonicus, palpitations, syncopes, and every other symptom of angina pectoris. He states that numerous observers have found hepatic enlargement to attend steno-cardia, and says that pains truly hepatic are often referred to the heart, and various other organs, which he enumerates. He adds, however, that obstructed circulation through the heart is a frequent cause of hepatic disease, and that in such cases the heart is usually found enormously enlarged. But whatever may be thought of Portal's opinions, his facts are valuable. In the second part of his work on the Liver, he gives, in the eleventh article, eleven cases in which the liver was found enlarged, dyspnœa, &c. having existed during life, and in two or three of which traces of pulmonic and cardiac disease are noted. In his twelfth article, he gives eight cases of palpitations and syncope from steno-cardia, depending, he conceived, on hepatic disease. In all the eight, the liver was found enlarged after death; and nearly all were observed to have enlargement of the heart, and other pectoral disease. Many recent writers in Britain and France have noticed the connection of abdominal visceral enlargement, more particularly hepatic, with cardiac disease. The writings of Doctors Bouillaud, Lobstein, Abercrombie, Hope, Latham, Bright, Andral, Copland, and others, contain distinct statements to that effect, and many examples. The work of Professor Bouillaud, "Du Cœur," contains more examples of abdominal visceral enlargement than any recent writer that I know of. For examples, vide Cases 21, 23, and 24. Observations 43, 51, 53, 57, 60, 61, 62, 63, 68, 69, 72, 119, 121, 125, 129, 130, and 132: in all of which the heart was of course diseased, and the liver is recorded as enlarged, and in several instances other abdominal viscera also. In Lobstein's Pathology, in the article "on the Heart," there are three cases at least in which the coincidence between cardiac and hepatic enlargement is noted. Dr. Abercrombie has mention of the fact just referred to in three of his cases in his paper in the Edin. Med. Chir. Trans.; viz. Cases vii. x. and xi. Dr. Hope records the pathological connection under consideration, in several of his cases, as in C. iii. ix. xv. xxii. in his work on the Heart. Dr. Bright mentions in his valuable Medical Reports, that in several cases the coincidence between pectoral and abdominal hypertrophous disease, so far at least as the liver and heart are concerned, was observed by him. For examples, see his 7th, 22d, and 24th cases. Dr. Latham informs us in his instructive lectures delivered in this place, and published in the Medical Gazette, vol. iii. that he is familiar with the occurrence of enlargement of the abdominal viscera as a complication or effect of morbus cordis; and he specifies the liver, kidneys, and spleen, as the organs most liable to hypertrophy under those circumstances. Dr. Copland mentions the enlargement of the abdominal glands, as according to his observation a common complication of heart disease, in his articles

"Asthma," "Disease of the Heart," &c., in his well-known and admirable digest of professional opinion and experience. Vide p. 94.

The opinions of the authors just quoted, are by no means in harmony on every point, and vary especially, I think, on the subject of ætiology. But to the fact of the occasional connections so often named, they clearly all bear witness, more or less decidedly.

The acquaintance of German pathologists with abdominal and pulmonic complications of morbus cordis, is evinced by Kreyssig, who speaks at length about it in his sixth chapter; while Testa, speaking we may suppose for Italy, assures in his eighth chapter, that in most bodies of cardiacs he has found the liver enlarged and elevated above its normal situation, so as sometimes even to surpass the third rib.

In fact, there is no organ that I have examined, respecting which I have not met several notices in preceding accounts, excepting the stomach, the encephalon, and the cerebellum, which have not been, so far as I know, examined with views similar to mine; and the pancreas, of which, as enlarged in morbus cordis, however, I have seen some notice, I think, in *post mortem* reports, to which I have mislaid my references.

Summary conclusion.—It may then, I think, fairly be assumed that visceral hypertrophy and enlargements are usual attendants of morbus cordis in every cavity; and that if there are exceptional cases (and how should there be a rule in physiology, mordid or healthy, without exceptions?) such cases constitute but a small fraction of the sum total of cases of diseased heart, and confirm that rule, of the truth of which they are part of the evidence.

Deductions from foregoing observations.—Having thus given a summary view of some of the principal results of more than five hundred post mortem examinations of persons above puberty, and without selection of cases, I proceed shortly to state such observations as may be suggested by the facts related, as throwing light upon the diseases of the heart; and before entering on any particulars of this second part of my enquiry, I would make one or two general explanatory remarks, in order to avoid the necessity of interjecting any thing personal to myself into the body of the argument.

Preliminary observations.—Practical medicine is to be cultivated, not by one method only, but by several. The principal are *the natural history method*, and the *numerical method;* which latter might also be called the empirical or statistical method. The former necessarily precedes the latter. To examine, classify, and describe objects—diseases or morbid changes, for example—is the first step in all scientific medicine; and beyond this first step little progress has as yet been made in the science. But when the enumeration and description of the genera, species, and varieties of the causes, signs, effects, and remedies of diseases are completed, practical medicine is only begun; for a second and more difficult

step remains to be accomplished, which is, for all social and technical purposes, as necessary as the first, and has for its end the fixing with precision the relative practical value and importance of the objects examined and classified, by ascertaining for each respectively the order and frequency of its occurrence, and the extent of its distribution, and the limits of its power and duration; and thus accurately defining the preponderant tendencies of each, in its relations to life and health. This step is made principally by the aid of numbers, without some aid from which, direct or indirect, it cannot well be done at all. A small or little varied experience may, perhaps, be correctly estimated by the rude informal arithmetic of recollection or memory. But in dealing with facts, numerous and complicated, memory is unworthy of confidence. From neglect of this in great part, no doubt, it is that the writings of many practical authors, especially the older authors, are so deficient in materials of rigorous proof or disproof; and might be justly entitled "Popular Essays," or "Magisterial Discourses on Medical Subjects," rather than contributions to practical science. Now, however, there is happily a better spirit abroad, and facts are more skillfully observed and more accurately recorded. But something still remains to be done, and more especially in the way of improvement of the means of observation; and the use of instruments of various kinds has as yet, I apprehend, been too much neglected. Partly owing to imperfections from this cause, in various works I have consulted, and partly owing to some peculiarity in the means of examination I have employed, I have been obliged to limit myself too exclusively to my own papers, for precise facts upon which to reason; and I think it advisable to mention this beforehand, lest, from not referring so much as I should like, or might be expected to do, to authors, I should be suspected of an indolence that had found reading laborious, or of a vanity capable of fancying it to be unnecessary.

STATISTICS OF MORBUS CORDIS.

Distribution or frequency, according to sex and age.—The first topic that offers itself for observation under this head, is the relative frequency of morbus cordis, as compared with other grave diseases of a character sufficiently defined for numerical comparison.

As already hinted, the facts and figures laid before the college in the foregoing observations, are some of the principal results of above 500 autopsies made within a limited period. Of these, above half were cases included in the class *Varia*, or diseases of various classes and kinds, exclusive of pulmonary consumption and disease of the heart. Of the remainder, between 70 and 80 above puberty were cases of consumption, of which two thirds were males above puberty; and the rest were cases of disease of the heat, of which

likewise two thirds nearly were adult males. The number, then, of cases in which the heart was diseased, occurring in a total of 520 to 530 inspections, was 170–80, or about 33 per cent.; and if we deduct from the total number of autopsies the cases of persons under puberty or fifteen years of age, amongst whom but two or three cases of diseased heart were observed, we shall then have as the ratio of disease of the heart to the whole number, about 35 per cent. Unquestionably such a ratio is enormous; exceeding by far the calculation of those most disposed to estimate highly the mortality attributable to the heart; yet I have myself but little doubt that, with some explanation, the following table (which, it will be observed, understates the case) will be found less extravagant than it may perhaps at first appear:—

Table deduced from Table 1, (*Table of Hearts*) *to show the Ratio of Phthisis and Morbus Cordis at each Interval of Age, to the whole of the Cases included in each Interval of Age.*[1]

	MALES.				FEMALES.			
	Phthisis.	Morb. Cord.	Ph.	M. Cor.	Phthisis.	Morb. Cord.	Ph.	M. Cor.
	Cases.	*Cases.*	*Per Centage.*		*Cases.*	*Cases.*	*Per Centage.*	
15 to 30	11 in 24	5 in 24	45	21	8 in 33	5 in 33	24	15
30 to 50	19 in 67	24 in 67	28	36	8 in 47	8 in 47	17	17
50 to 70	17 in 84	34 in 84	20	40.5	9 in 55	16 in 55	16.4	29
70 to 100	3 in 31	13 in 31	10	42	2 in 39	13 in 39	5	33.33

The principal explanatory remark I think it necessary to offer, is this, viz., my principal field of observation receives all poor applicants from a certain district, provided only their complaints are severe, making no distinction as to sex, age, or disease, except small-pox, nor between curable and incurable cases, and in general entertaining all the latter until the end of life, unless the sufferers voluntarily withdraw. The effect of this system of admission is, that, compared with other asyla of sickness, the parochial infirmary, so governed, has, according to well known laws of mortality, an annual loss of life much exceeding that of county infirmaries and city hospitals—a mortality, it is to be remembered, that is augmented very considerably by accessions of cases dismissed from other charities as incurable. For the effect of this comparatively indiscriminate admission, and unlimited retention of patients, of course a large allowance must be made. What the exact amount of that allowance should be, I am not prepared to say; but if it be assumed at the immense proportion of 50 per cent. of the fatal adult cases, which I am quite sure is much over the mark, we shall still have

[1] The heart table contains no case of valvular disease, nor more than four fifths of the simple hypertrophies.

a ratio of heart disease for which probably few of my hearers will be prepared.

Ratio of phthisis to other diseases, according to authors.—The extravagance of the ratio will probably appear still greater when we compare the amount of cases of phthisis with that of morbus cordis. Phthisis, or tubercular pulmonary disease, is, and has long been held by pathologists and medical statists to be by far the more frequent of the diseases of these and all other temperate climes. The accomplished Dr. Young, writing in 1815, attributed to phthisis, as Heberden, Woolcombe, Wells, &c. had previously done, full 25 per cent. of the whole mortality of England. He begins his remarkable work on Consumptive Diseases thus :—"Consumption is, in almost all civilised countries, the most extensively and inevitably fatal of diseases." And elsewhere (p. 41) he says :—"The frequency of consumption in Great Britain is usually such that it carries off about one fourth of its inhabitants. At Paris the mortality by consumption has been estimated at one fifth, and at Vienna it is said to be one sixth of the whole. But the mortalities at Paris, and in the south of France, from consumption, have frequently amounted to one fourth of the whole." And seven years previously to the publication of Dr. Young's work, Dr. Woolcombe, of Plymouth, calculated that the annual mortality in England from consumption alone, amounted then to 55,800 persons.[1] And Sir James Clark's estimate is apparently higher than Dr. Young's, being for the 121 years ending with 1821, as follows :—

For the year 1700	the deaths from consumption were to all the deaths of the year	.145
1700 to 1750		.214
1750 — 1801		.263
1801 — 1811		.288
1811 — 1821		.316
General average for the 121 years		.245

or 1 in 4; and he adds, "It now appears (1835) to constitute one third of the whole mortality."

The difference between my own conclusions and those of the distinguished authors just referred to—conclusions in which they are supported by the principal recent writers on the subject, as Benoiston de Chateauneuf, and Lombard, &c. will seem the more wide and irreconcileable for this reason: Drs. Woolcombe and Young, as is well known, wrote at a time when the name of phthisis or pulmonary consumption was extended to other pulmonary affections besides that to which it has been limited by Sir J. Clark, Dr. Lombard, and other writers who have published since the appearance of Laennec's great work; so that if, before 1819, tubercular consumption was the cause of but part of the twenty per

[1] Remarks, &c. p. 73.

cent. of popular mortality, attributed justly enough to chronic pectoral, and most pulmonary disorders, then, on that supposition, the proportion of deaths referable to pulmonary consumption in the old and looser sense is now much increased, since the present mortality from true phthisis, in the stricter sense of Laennec, is held by the high authorities above named to amount to one in five, or thereabouts, being the same per centage of mortality as was previously attributed to several chronic pectoral affections of which true phthisis constituted but one, though no doubt a principal species.

Now the doctrine maintained by Young is true, although, for practical purposes, perhaps, it is obsolete. In addition to the facts advanced by that very learned writer, in support of his opinion, others concur in the same conclusion; amongst the rest this hitherto unpublished observation.

Between May 1821 and May 1835, there were recorded in the journals of the Marylebone Infirmary, under twenty-six principal heads of disease, nearly 4000 (3990) deaths, viz.:—

1.	Encephalic diseases, amounting together to 489:—	
	Apoplexy,	182
	Paralysis,	165
	Convulsions,	50
	Phrenitic cases,	71
	Tetanus,	5
	Epilepsy,	16
2.	Pectoral diseases, amounting to about 2300, viz.:—	
	Phthisis,	991
	Asthma, 733 / Morbus cordis, dropsy, and hydrothorax, 382	1115
	Inflammation of lungs and pleura,	208
3.	Abdominal diseases, 732, viz.:—	
	Cholera,	102
	Inflammation of bowels,	65
	Chronic disease of liver,	59
	" " stomaah,	16
	" " kidneys and bladder,	29
	Dysentery,	204
	Tabes (infantum),	257
4.	Pyrexiæ—Continued fevers,	237
	Exanthemata,	70
	Erysipelas,	43
5.	Scrofula (42), and old age (57); together,	99
		3990

In addition to the preceding there were about 400 other deaths from minor sources of mortality, making with the former nearly 4400 deaths in the period. Now of the total 4400, as already stated, nearly 1000 (viz. 542 males, and 449 females) were deaths from phthisis, understood in the larger sense of the word, as used

by Dr. Young, which gives a per centage of $22\frac{1}{2}$ on the whole mortality of the fourteen years. This observation fully bears out Dr. Young's estimate, as well as those of Drs. Wells, Woolcombe, and Heberden, and other English estimates anterior to 1819.

Such estimates questionable.—But the limitation of the term Phthisis, or P'thisis, by Laennec, to tubercular phthisis, on account of its superior fatality and more extensive distribution, as compared with other chronic and strictly pulmonary disease, while it has narrowed the field and rendered more precise the objects, has, at the same time, made more difficult the means of enquiry. And at the present time it is difficult to place confidence in any results not obtained by diagnosticians of unusual skill during life, or by careful post mortem examinations by practised pathologists. So that admitting the general correctness of Woolcombe, Young, &c., I am much less disposed to coincide in the views of the medical statists that have written subsequently to the general promulgation of the discoveries of Avenbrugger and Laennec, in the great work of the latter. There is much reason, in truth, (and with the highest respect for the very able and distinguished writers above named, I say it,) to suspect the data on which their calculations were founded. How small a proportion, in fact, of the mortality included in those estimates has arisen from disorders proved strictly phthisical or even pulmonary, by competent diagnosticians during life, or by proper inspection post mortem! For my part, I have no doubt at all that the greater part of the so-called pulmonary consumptions in persons above thirty years of age, have been in reality mere chronic catarrh, complicated with hypertrophy of the heart and air tubes. But whatever may be thought on that point as a general position, it is very certain that the proportion of morbus cordis included in the 520, and odd cases so often referred to, much exceeds that of phthisis. The cases of heart disease amounted to 170, to speak in round numbers, and those of phthisis to less than half, or about 80. Now this difference has not been caused by any selection at admission, or at the time of post mortem inspection. Every proper case was admitted on application; and every case that proved fatal, and for which permission could be obtained, was examined without distinction of disease. That it was not mere accident, seems probable from the fact, that in the case of either sex the preponderance was in favour of heart disease. In the case of the males the ratio of phthisis to morbus cordis was as two to three; and in that of the females it was as nearly six to seven. I confess it seems to me more probable that the difference between the generally received proportion of disease of the heart to other diseases, especially phthisis, and that obtained by myself, is owing to this, viz. that on the one side the diagnosis has been, in a large proportion of cases, conjectural during life; while, after death, no sufficient examination has been made; and that on the other side the diagnosis has been always based on instrumental as well as anatomical examination. This, I say, seems more probable

than that the result at which I have arrived, with the aid of unusual facilities and precautions, should be so far wide of the truth as to represent a disease that really amounted to one fifth of the whole fatal disease of the country, as one half less frequent, even in a single district, than another disease, of supposed comparatively rare occurrence. Whatever, also, it is to be noticed, may be the effect of indiscriminate admission and protracted residence, it is common to both diseases, so far as my observations are concerned, and cannot be supposed to affect the ratio. So that on the whole, when I recollect the numerous diagnostic errors into which I have myself fallen, in pectoral diseases, and those I have known committed by other practitioners, and call to mind the difficulty in general of accurate diagnosis in the same class of disorders; remembering also the recency of the promulgation of the invaluable mechanical semeiology of Avenbrugger and Laennec, and the confusion not yet sufficiently remedied, of several distinct diseases, commonly classed under the one name of *Consumption*, or *Decay*, and its synonymes, viz. :—1. Chronic bronchitis, occurring in scrofulous and cachectic subjects, with loss of flesh and some fever. 2. Chronic cough, complicated with, and rendered inveterate by, hypertrophy of the bronchial ramifications and dilatations of the air-cells. 3. The same complicated with, and rendered incurable by, morbus cordis, generally on the left side, sometimes on both sides of that organ. 4. True phthisis, which is always complicated with bronchitis, and pretty frequently with considerable hypertrophy of the heart. 5. Glandular marasmus in children, without in many cases any strictly pulmonic disease;—when I recollect those facts, I cannot avoid feeling very sceptical as to the alleged paramount importance of true phthisis; and suspecting that in male adults at least, the most frequent of all fatal chronic disorders of these islands is disease of the heart. In this, perhaps, rash assertion, I have the satisfaction of finding that I go but one step in advance of one of the ablest practitioners, and largest and least fanciful observers that have especially studied the pathology of the heart. Baron Corvisart affirms, without hesitation, that the most frequent organic diseases, pulmonary consumption excepted, are those of the heart; and that death from cardaic lesion is much less rare than from lesion of either the brain, the stomach, the liver, the spleen, or the kidneys; or perhaps from all those organs together.

Contrast between morbus cordis and phthisis, in their relations to age, further illustrated.—Before passing on to the next topic, I may be permitted to dwell for an instant on a remarkable contrast between morbus cordis and phthisis, in their relations to age, which is shown in the first table deduced from the table of hearts, and which is in some degree curious in itself, but is at any rate pertinent enough to my present argument. If on the male side of the table we compare the distribution of morbus cordis with that of phthisis, we find a striking difference. The per centage proportion of morbus cordis, to the total number of cases, including phthisis

and morbus cordis at each interval of age, is as follows:—For the first, from 15 to 30, it is 21 per cent. For the second it is 36; for the third it is 40½; and for the fourth it is full 42 per cent. Whereas, for phthisis, the distribution changes in an inverse manner; being for the first age 45 per cent.; for the second, 28 only; for the third, 20; and for the fourth, 10 per cent. only, or one fourth only of what it was before 30. Then, on the female side, we have results agreeing sufficiently with those just stated on the male to render it probable that there is something more than chance in the matter. On the female side we obtain the following facts:—Morbus cordis gives for the ages 15 to 30, 15 per cent.; from 30 to 50, 17 per cent.; and from 50 to 70, the ratio rises to 29 per cent.; and above 70 years, to 33⅓ per cent.; while, on the female as well as on the male side, phthisis seems to decline with age, being, for the first interval of age, 24 per cent.; for the second, a little more than 17 per cent.; and for the third about the same, 16.4; and for the fourth only 5 per cent. Now the conclusion to which these facts lead, viz. the superior prevalence of morbus cordis as compared with true phthisis, at advanced ages, is confirmed by several passages in the classical work of Sir James Clark; especially by statements illustrating the influence of sex and age in the production of phthisis. In Chapter VIII., tables are given, exhibiting the mortality from phthisis above 15, in seven cities of Europe and America; which show that in almost each city there is a pretty uniform decline in the ratio of deaths from phthisis, from twenty years to extreme age; and the facts furnished by the excepted city —viz. Berlin—are at least a century old, being taken from Süssmilch. In Edinburgh the ratio declines from .285 at 20 years, to .052 above 60. At Nottingham, from .416 to .017, in the same period of time. At Chester, from .245 to .054; at Carlisle, from .290 to ·097; and at Paris, according to Louis, from .325 to .042; while the general average decline was from .285, or 28.5 per cent. at 20-30, to .078, or 7.80 per cent. above 60 years of age.

The following unpublished table, deduced some time since by my brother, Dr. G. Clendinning, now not in the profession, from observations registered at the Marylebone Infirmary, confirms the results to which Dr. J. Clark's enquiries have led him.

Of 1044 deaths from phthisis, occurring in the workhouse and infirmary jointly, of the parish of Marylebone, between May 1821 and December 1835, the distribution according to age was as follows:

Ages.	Deaths.	Ages.	Deaths.
Under 5 years . . .	70	From 40 to 50	164
From 5 to 10	17	" 50 to 60	121
" 10 to 20	53	" 60 to 70	97
" 20 to 30	247	" 70 to 80	45
" 30 to 40	222	" 80 to 90	7
	Total		1044

The following table gives the per centage distribution of phthisis, according to the preceding observation :—

	Per Cent.		Per Cent.
Under 10 years	$8\frac{1}{2}$	50 to 60 . .	$11\frac{1}{2}$
10 to 20 . . .	5 nearly.	60 to 70 . .	$10\frac{2}{3}$
20 to 30 . . .	$23\frac{1}{2}$	70 to 80 . .	$4\frac{1}{3}$
30 to 40 . . .	$21\frac{1}{2}$	80 to 90 . .	$\frac{2}{3}$
40 to 50 . . .	$15\frac{1}{4}$		
Total			100

According, then, to the above, and Sir James Clark's table, the distribution of phthisis according to age is nearly such as I have stated, viz. phthisis declines in frequency soon after puberty, and has become comparatively rare in middle life, when it is for the most part superseded, as I conceive, in frequency and fatality by morbus cordis; and in extreme age, it disappears nearly altogether. It is to be regretted that, with respect to morbus cordis, I am precluded from producing a similar confirmation of my results, partly owing to the frequent exclusion of aged people from hospitals, and partly owing to the neglect of instrumental means of post mortem diagnosis, and the confidence misplaced by pathologists in their manual and visual skill.

CAUSES OF MORBUS CORDIS.

Influence of sex and age, and valvular defect.—The next topic for observation is the proximate and other causes of morbus cordis. It has been already cursorily stated that, of 170 to 180 observations of this disease in various stages and degrees, little less than five sixths were cases of simple hypertrophy, and the remaining one sixth only examples of hypertrophy with valvular disease.

Summary of facts.—In the cases of simple hypertrophy, nearly all had thickening or increase of muscular substance on the left side, principally in the ventricle; and in a large proportion of old subjects, the left ventricle alone was observed to be materially affected. In a considerable proportion of cases, which I have not recorded with sufficient accuracy for counting, there was enlargement on the right side, sometimes hypertrophous obviously, but often it appeared to me but an effect of distension by blood and mechanical dilatation in the final struggles. Of the cases, including unequivocal valvular disease, only three presented that morbid condition on both sides, or one in ten; while the remaining nine tenths had valvular defect on the left side exclusively. In both classes of cases of hypertrophy, viz. the simple, and the complicated with disease of the valves, there was the same preponderance of males over females, viz. about : : 2 : 1. In both classes of cases there was the same preponderance in the advanced intervals of age over the first interval of from fifteen to thirty. In both sexes the proportion of cases

of hypertrophy, whether complicated or not, increased with the age. On referring to the table of hearts, it appears that of about eighty cases of simple hypertrophy of males, but five occurred before 30; twenty-four happened between 30 and 50; thirty-four between 50 and 70; and thirteen beyond 70. And on the female side, in a total amounting to forty-three, in the interval 15 to 30, but five happened; in the second, eight cases occurred; and sixteen are noted in the third; and fourteen in the fourth period. And of the complicated cases, but one male and one female were under 30. From these facts it would appear very decidedly that sex and age have most important influences, as predisposing causes of morbus cordis, and that in general, hypertrophy of the heart is, if at all, then but occasionally an effect of valvular disease of that organ. With regard to sex, it seems that the male is more disposed to the disease by one half than the female; not only to the simple hypertrophous form, but also to the endocarditic or valvular.

Additional proof of increase of cardiac nutrition, &c. with age.—With respect to age, the tendency to augmented nutrition advocated in the previous lecture, when defining the normal heart, and proved by examination of a large number of healthy male and female hearts, is further strengthened by the facts of this section. The increasing intensity, so to speak, of the nisus nutritivus is proved by the constant advance above shown in the normal weight of the heart with advance of life; and the diseased heart shows likewise the intensity of nutrition to be proportioned to the age. For the male the average for morbus cordis was, for the four intervals of age above 15, as follows:—

14½ ounces was the average of five cases under 30.
17 ounces the average of twenty-four cases under 50.
15 ounces the average of thirty-four cases under 70.
15 ounces the average of thirteen cases above 70.

While for the female labouring under morbus cordis, the following were the numbers:—

12·2 ounces the average for five cases under 30.
12·37 ounces the average for eight cases under 50.
14½ ounces the average for sixteen cases under 70.
12½ ounces the average for fourteen cases above 70.

So that amid the general shrinking from diminished nutrition that attends advanced age, the male heart was heavier and more voluminous over 70 than under 30; and the female heart increased uniformly up to 70, when the degree of hypertrophy considerably exceeded that of any former interval, advancing from 12⅓ ounces to 14·5 ounces between 15 and 70, and not declining after 70 below 12½ ounces.

Influence of valvular disease.—With respect to the influence of valvular disease in particular in the production of hypertrophy, it appears probable, *à priori*, that the law of muscular nutrition that

determines increase of volume as a consequence of increased exertion, applies to the heart in common with other muscles. The increase of thickness in the left ventricle attending advanced age might be supposed to result from diminished elasticity in the aorta, which is known to acquire normally a certain degree of rigidity through time. The same explanation occurs readily to account for hypertrophy attending aortic aneurism, rigidity, or shrinking of the semilunar valves, &c. But such a view will not account for such effects as the increase of volume and weight so often observed in the hearts of phthisical subjects.

Hearts enlarged in phthisis.—In twenty-three males dead of phthisis, from 30 to 40 years of age, for example, I found the average for the heart to be 10 oz.; and in twenty other cases, between 50 and 70, I found it to be 10¾ oz.; both averages exceeding considerably the corresponding averages for the healthy heart. Now as there was no mechanical impediment to the action of the left ventricle, which participated fully, and as much as in any other class of cases in the hypertrophy, such a fact requires an entirely different explanation from that referred to above.

No proof of prior disease of valves.—Then, again, it may be asked, what evidence is there that valvular disease is a frequent antecedent, and therefore may be a frequent cause of ventricular hypertrophy? And I know no facts that would justify a confident reply in the affirmative to that question, which I apprehend has been cut through hypothetically, not experimentally untied.

Author's view of the causation, with reasons.—The view of the matter that appears to me at present the most probable, is this:—Hypertrophy results from vital causes exclusively, and not from mechanical ones; and the more usual result of the action of those causes, where sudden and intense, is inflammation; but when moderate and gradual, they rather produce hypertrophy—a condition akin to inflammation, and one that augments enormously the susceptibility of the inflammatory process with which every part is normally endowed. Now to such supposed hypertrophy as the limit beyond which the operation of the vital causes referred to does not ordinarily pass, and to the morbid susceptibility of inflammation in every part too plentifully supplied with nutrient fluids, which such hypertrophy implies, I would refer almost all valvular disease occurring in mature years, especially in males, and such as could not be attributed to obvious causes, as falls, blows, or well-marked cardiac rheumatism, &c. I would thus in great part reverse the order of causation usually received, and attribute much of the valvular disease to inflammation, mainly induced, if rheumatism be excluded, by previous hypertrophy, as a most potent predisposing cause. The facts on which I found this opinion are shortly these:

1. Most cases, the great majority, in fact, of those of morbus cordis, have no disease of the valves. (I speak now of my own observations only, as the neglect by pathologists of instrumental means of diagnosis has put it out of my power to adopt, with full

confidence, their negative conclusions from their examination of subjects dead of heart disease.)

2. No case of valvular disease, with a trifling exception above alluded to, (Med. Gaz. p. 504, c. 1,) has occurred to me, uncombined with hypertrophy of the parietes, especially in the left ventricle.

3. Hypertrophy and inflammation are but different stages or degrees of the same process of over-nutrition by afflux and stasis of blood.

4. A large proportion, at least one sixth or one eighth, of the subjects of morbus cordis, are hurried off by pericarditis with or without endocarditis supervening upon an advanced stage of the disease, and attributable, I conceive, to the disease as to its principal predisposing cause at least.

PATHOLOGICAL RELATIONS OF THE ENLARGED HEART TO THE ABDOMINAL VISCERA.

Opinions of authors.—In the ætiology and pathology of the older writers, the influence of the abdominal viscera over those of the chest was considered very extensive and energetic. Asthma, dyspnœa, angina, syncope, hydrothorax, chronic cough, and other pectoral diseases, were attributed to affections of the stomach, liver, spleen, &c., and many pathologists still consider that, amongst the ventral organs, several are frequent causes of organic and other grave disorders in the chest, as well as in the other visceral cavities.

Such opinions conjectural.—Now if tangible evidence of the views just referred to be asked for, I am not able to point out where it is to be found. In reply to the question, has any advocate of the abdominal origin of pectoral diseases, published pathological facts sufficiently numerous, various, and pointed in proof, that such morbific influence of the abdominal viscera is real and important, I am obliged to answer that I know of no such collection of facts and proofs. Ingenious explanation, probable opinions, and striking cases, have, I am aware, been published; but the two former have been in my judgment too hypothetical, and the latter too few in number and equivocal in meaning; and on the whole, after considerable attention to the subject, I have had forced on me the conclusion that pathologists must have often mistaken effects for causes, and causes for effects; and, that wanting convenient and accurate tests of cardiac disease, and wanting still more some ready explanation of striking symptoms and morbid appearances, they found themselves necessitated to fix on the liver, spleen, or other abdominal viscera, in the absence of apparent probabilities in some other direction.

But there seems to me to be little in disease to warrant such opinions. Let me ask, how should hypertrophy of the stomach or encephalon produce general cardiac hypertrophy? Or how should hypertrophy of any organ, the lungs not excepted, be capable of

causing hypertrophy of the left side of the heart? I have given above facts of various kinds, and of an unequivocal character, as I conceive, in proof that hypertrophy of the heart is accompanied ordinarily by increase of weight and volume in the stomach and brain, as well as in every other viscus. Now assuming the correctness of these statements, how are such facts to be accounted for by abdominal morbific influence? In the physiology of health, the brain has apparently a more immediate and extensive influence over the heart, than any abdominal viscus; and of the abdominal viscera, unquestionably the apparent influence of the stomach exceeds in extent and energy that of the liver, spleen, pancreas, or kidneys; yet with a few exceptions, the brain and stomach have been excluded from the morbid causation by most advocates of the abdominal origin of pectoral diseases, and the whole of the supposed morbific power has been referred to organs inferior in apparent importance, energy, and influence. This might of itself beget suspicions—suspicions too which when once entertained, must quickly gather strength from further enquiry. Under such circumstances, one consideration will probably be found of great weight with the indifferent enquirer; viz., that the functions of the alleged morbific organs are in some cases wholly unknown, and in almost every case but very imperfectly ascertained.

Abdominal visceral functions too little known.—Of the splenic function, so far as I am aware, nothing is known: of the hepatic function I apprehend very little is known; and beyond the secretion of bile, a fluid of which the uses are yet somewhat problematical, nothing at all is known. Of the kidneys also, our knowledge is very imperfect. In consequence, then, of the obscurity that hangs over the uses of the abdominal viscera, the stomach perhaps excepted, there is in that quarter a large field open for conjectural ætiology, alike incapable of rigorous proof or disproof. The facility of assumption without risk of experimental or other satisfactory refutation that thus is seen to arise from our ignorance respecting the abdominal functions, ought to put the cautious *naturæ minister ac interpres* on his guard, and will, with other considerations, in all probability satisfy many, if not all indifferent enquirers, of the utter inadequacy of any facts that have yet been made public to substantiate a doctrine in itself so little probable as the abdominal origin of organic cardiac diseases.

The visceral enlargements of morbus cordis probably dependent on the cardiac disease, and not causes of it.—If, then, we exclude abdominal visceral influence from the ætiology of morbus cordis, how shall we explain the almost constant connection between cardiac disease and visceral enlargement in the abdomen as well elsewhere? To this question I see no satisfactory answer but this: that those visceral enlargements are, in some way or another, effects of the disease at the centre of circulation; and the grounds of this conclusion are summarily these:—

1. Morbus cordis is usually found to coincide with enlargement of all, or several of the viscera of the great cavities.

2. Some viscera which, from the nature of their functions and other reasons, appear less capable of affecting, in an unequivocal manner, the nutrition of the heart, such as the encephalon and stomach, pancreas and kidneys, are nevertheless found to participate equally with others that have more intmate anatomical and physiological relations with the heart, as the liver and lungs, in the general visceral hypertrophy attending morbus cordis.

3. Abdominal visceral hypertrophy is often met with without any disease in the heart. *Ex. gr.* of thirty and odd instances in the five hundred and odd cases from which my tables have been constructed, more than thirty cases had excess of weight in the liver of from ¼ lb. to 6 lbs. above the normal average, but without any decided abnormal development of the heart, viz., cases of phthisis amounting to nearly one third of the whole; cases of puerperal peritonitis amounting to four; as many cases of erysipelas, and of carcinoma uteri, and uterine hemorrhage, each one case; and ten or twelve other cases. One of the phthisical livers weighed 6½ lbs.; and another enormous liver that occurred in a male, dead of ascites with black or rather dark-green jaundice, weighed 154 oz., or 9 lbs. avoirdupois.

4. Chronic bronchitis, emphysema, and œdema pulmonum, &c., although apparently capable of obstructing the circulation more effectually than any abdominal hypertrophy and enlargement or induration of equal amount, are, when unattended by morbus cordis, usually quite free from abdominal visceral hypertrophy. *Ex. gr.* of eighteen cases of chronic bronchitis, nearly all the adult cases of that disease that I have met with, in which there was detected no enlargement of the heart, there was in no case any decided hypertrophy of any abdominal viscus, nor of the encephalon.

It is true that in phthisis, as I have stated in the paper in the Transactions of the R. M. C. S. D., I have usually found an enlargement of all the viscera; less considerable, indeed, than in well-marked morbus cordis, but yet sufficiently unequivocal. And this by itself would certainly appear to favour the opinion that morbid conditions of other viscera than the heart, might, if apparently capable of impeding the circulation, be reasonably supposed to produce more or less of the visceral enlargement and hypertrophy usually met with in morbus cordis. But in the same paper I have shown, or made it probable, in opposition to Louis and other authorities, that in phthisis the heart usually exceeds the normal dimensions in both sexes; and it is to this circumstance principally that I would at present refer the general visceral hypertrophy, commonly found in subjects dead of phthisis.

A

TREATISE ON NEURALGIA.

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TO

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THE AUTHOR.

39, *Queen Square, Bloomsbury,*
September, 1838.

If the importance of a disease were estimated according to its tendency to a fatal termination, Neuralgia would not be entitled to much notice; but it will demand the highest degree of attention, if the distressing character of its symptoms be taken into consideration.

The sufferings which frequently attend this dreadful malady cannot be exceeded, debarring the unfortunate patient from the pursuit either of business or of pleasure. When he seeks relief by mixing in society, he is constantly exposed to the action of causes which excite the return of his torture, and he is therefore doomed to a life of seclusion, generally when at an age of which hope and enterprise are the natural characteristics.

Neuralgia is a disease of frequent occurrence, appearing in a great variety of forms, and attacking every organ endowed with sensibility; it often stimulates other diseases, and may sometimes be mistaken for affections of a fatal character. The existence of inflammation, for instance, being suspected, active depletion may be employed, with no other effect than that of increasing the severity of the symptoms. On the other hand, to treat an inflammatory attack as neuralgia, would be attended by consequences still more serious. In some cases which have been abandoned as hopeless, upon the suspicion of organic and incurable disease, the symptoms have been subsequently found to depend upon neuralgia, and have either been cured by simple means, or have terminated spontaneously.

There is nothing more distressing to the feelings of a physician

than to be called upon to witness sufferings that he cannot relieve; and in no affection oftener than in neuralgia are the resources of medical skill exhausted in vain. Yet much may be gained by a careful and patient study of the habitudes of the disease; it is in the power of medicine to assuage, if it cannot always remove, the anguish of the patient; and, by well directed treatment, a complete and permanent cure may often be effected.

The question whether neuralgia ought, in strict propriety, to be regarded as a distinct form of disease, will be more advantageously entered upon, when its history, and particularly the nature of its exciting causes, have been examined. It may be objected, that many of these causes are themselves diseases, of which the neuralgia is merely symptomatic, and therefore that no separate description is required. But, on the other hand, it must be remarked, that in many cases no primary disease can be discovered; and even where this connection is evident, there is often a remarkable disproportion between the original affection and the neuralgia that proceeds from it, for the greatest suffering is frequently occasioned by the most trivial causes; that the neuralgia may be suspended or removed, although its primary cause continue, and is, from its nature, permanent;—that in many cases a cure is effected by means, the tendency of which would be to aggravate the symptoms of the original disease; and that the neuralgia often commences when the affection by which it was excited is declining, or has entirely disappeared. It is, moreover, one of the most formidable ills to which human nature is exposed, inducing the patient to submit to the most dreaded remedies; for with only a remote chance of obtaining relief, successive amputations have sometimes been performed. It is therefore hoped, that a work, whose object is to present a view of the principal points connected with an affection so formidable, will not prove altogether useless or unacceptable.

The term neuralgia, derived from νεῦρον nerve, and ἄλγος pain, was first employed by Chaussier,[1] who composed an excellent table, which contained all the different species of the complaint observed at the period of its publication. It is much to be regretted that this term is not universally adopted, as great confusion is still occasioned by the multiplicity of names employed by authors in speaking of the disease.

Another source of confusion arises from the different significations in which this term is employed. It was limited by Chaussier, and subsequently by other authors (in accordance with its etymology), to denote a morbid condition of the sentient nerves; but it has latterly been used in much more extended sense, to express the analagous affections of nerves possessing different functions, by which change of expression, diseases bearing no resemblance to each other in their external characters, are classed together such as certain forms of asthma, aphonia, vertigo, &c. It seems preferable

[1] Table Synoptique de la Névralgie.

to restrict the term to the sense in which it was originally employed, and in this treatise it will be confined exclusively to that signification.

Much has been written respecting the antiquity of neuralgic affections, and several passages in the old medical authors have been commented upon, where they are supposed to refer to these complaints; some of them, it must be acknowledged, are sufficiently vague and obscure; yet, when the nature of the disease and of its exciting causes is considered, no doubt can remain that it must have prevailed in every period, although it is probably more common in some conditions of society than in others; however, in consequence of the slight knowledge of pathology which existed in former times, disorders, different in their nature, but possessing any remarkable symptom in common, were classed together under the same name, and accordingly the neuralgiæ appear to have been confounded with other painful affections, such as gout, rheumatism, &c.[1]

It was not until the middle of the last century that neuralgia became the subject of minute observation, and obtained a separate description. This investigation was first excited by the publication of several excellent papers on tic-douloureux; subsequently, the disease was observed in nerves of other parts of the body, and the subject has been gradually advancing in interest and importance until the present day.

Nosology.—The neuralgiæ are not placed in a separate class in the nosologies of Sauvages and Cullen, but are arranged by these authors under several orders. Pinel[2] places neuralgia in the third order of his fourth class, neuroses,[3] and gives it the following definition:—

"Douleur vive et déchirante, avec des élancemens, et des tiraillemens successifs, sans chaleur, sans rougeur, sans tension et gonflement apparens. La siége de la douleur est fixé sur un tronc ou sur une branche du nerf, et elle semble s'elancer du point primitivement affecté sur toutes ses ramifications."

Dr. Good places the disease as the sixth genus of his fourth class, neurotica. He describes it as follows:—

"Acute sensibility and lancinating pain in the course of one or more branches of nerves in an organ; mostly with irregular motion of the adjoining muscles; recurrent in short paroxysms, with indeterminate intervals or remissions."[4]

This disease cannot be described, however, in such brief sentences; it varies exceedingly in its symptoms;—the following description is intended to represent its most common form.

[1] See Neuralgia facialis.

[2] Nosographie Philosoph. vol. iii.

[3] Lesions du sentiment et du mouvement sans inflammation ni lesion de structure.

[4] Study of Medicine, vol. iii.

Symptoms.—The pain is of a peculiar character, being usually described by patients as thrilling, shooting, darting, plunging, &c. It attacks in paroxysms, consisting either of a single stroke of excruciating agony, or, more commonly, of a succession of shocks, which rapidly follow each other for a few seconds, and then vanish, leaving in many cases an obscure aching pain, and rigidity of the neighbouring muscles. It is sometimes seated in a particular nerve, whose course it follows accurately, and darts like an electric shock along its ramifications.

In the majority of cases, the pain shoots towards the terminal extremity of the affected nerve, and is felt most acutely in its cutaneous branches; but it sometimes takes the contrary direction, ascending from the extremities of the nerve towards its trunk.

It sometimes darts from a central point both upwards and downwards;—at others, it flies rapidly along the nerve, and again returns through the same course, to the point where it commenced;—at others, and much more frequently than is usually represented, it radiates in all directions, without observing the course of any nervous branch.

There is also considerable variety in the apparent velocity of the pain as it shoots along the affected parts. In general, as has already been remarked, the shock is instantaneous, but the painful sensation occasionally creeps slowly along the nerve, and, indeed, may be observed of every degree of rapidity.

The pain sometimes flies from one situation to another, attacking either a remote part, or the same set of nerves on the opposite side of the body; or it may pass from an external to an internal organ. These transitions are often performed with wonderful rapidity;—the disease is rarely observed in more than one situation at the same time.

The space occupied by the pain is also various. It is sometimes diffused over a large surface, but at others is confined to a point, which might be covered with the finger, and in general appears to be more severe in proportion as it is circumscribed.

The parts through which the pains shoot are sometimes exquisitely tender, but are frequently affected with numbness. In those cases where the pain is spread over a large surface, it is generally described as aching, but in addition to this, the more common lancinating pain darts through the affected part during the paroxysms.

When the seat of the neuralgia is near a secreting organ, the latter is often stimulated to increased action; a superabundant quantity of its natural fluid is separated, and with this symptom the paroxysm usually terminates.

In general, the seat of neuralgia presents no outward indication of disease; but its colour, temperature, and form, remain unchanged; the skin, however, is sometimes covered with a slight blush, whilst in other cases it is paler than natural; occasionally also a moderate degree of swelling and increased heat accompany the pain; and the

nerve itself, when seated superficially, has sometimes been observed to become prominent during the paroxysms.

The pulse is seldom sensibly affected, but in some cases it becomes slower at the commencement of an attack, and rises when the pain is at its height. Lentin has recorded a case where he observed the pulse to become slower by fifteen beats in a minute during the whole time of the paroxysms.[1] In a case of neuralgia of the ophthalmic nerve, Van Swieten thought he felt the pulsations of an arterial branch at the inner canthus of the eye, to be quicker, and relatively stronger, than in other parts of the body.[2]

In many cases no warning symptoms announce the approach of a paroxysm, the patient being struck suddenly with the most acute sufferings; in others, the attack is preceded by heat, cold, itching, throbbing, or some analogous sensation; and occasionally by a feeling similar to the aura epileptica. When the patient becomes aware by any of these feelings that an accession is at hand, the utmost horror is often manifested in his countenance; he implores assistance from those around him; or, endeavours to summon up all his fortitude to resist the attack, pressing the seat of the disorder with all his might, and sometimes throws himself upon the ground, totally overcome by the agony which he undergoes.

The attacks are sometimes periodical, returning at particular hours, with remarkable regularity. Several may take place on the same day, or they may assume the quotidian, tertian, or quartan type. Cases are also recorded where the intermissions extended to several weeks, or even to a longer period. Often, however, the attacks are altogether irregular, occurring whenever the patient is exposed to an exciting cause; and, indeed, frequently where none can be observed. In some cases the intermissions are incomplete, and the disease takes the remittent type, with well marked and more or less frequent exacerbations. These cases may be mistaken, particularly when the viscera are the seat of the disorder, either for acute inflammation, or for some organic disease; and it is sometimes difficult to give a decided opinion upon their real nature. This difficulty is moreover greatly increased, when, as sometimes happens, the lancinating character of the pain is not remarkable, and where the sufferings are increased by pressure over the part affected;—a careful enquiry, however, into the history of the case, will generally be sufficient to determine the practitioner in his diagnosis.

Complications.—It sometimes happens that neuralgia alternates with some other nervous affection, such as ague, epilepsy, &c. Sir B. Brodie mentions a case where it alternated with insanity.[3]

In the case of Sarah Willis the most violent enteralgia was succeeded by an attack of aphonia, and the latter was immediately removed after a free evacuation of the bowels.[4]

[1] Blumenbach's Medicinische Bibliotheck.
[2] Van Swieten Commentor. in Aphorism. Boerhaav, vol. ii. sect. 757.
[3] On Local Nervous Affections.
[4] Case I. at the end of the volume.

In another instance, that of Lucy Payne, nervous pains of the face and other parts alternated with a spectral appearance, which assumed the shape of a brilliant eye constantly beaming upon her.[1]

In Sherwyn, neuralgic pains alternated with chorea, involuntary screeching, and other nervous symptoms. Afterwards, she was, haunted for several hours each day by the figure of a black cat, which appeared to be staring at her from the opposite side of the room.[2]

The complaint does not always amount to absolute pain, but consists of some unusual sensation, such as itching, burning, cold, &c. returning in the same periodical manner, and presenting other general characters of neuralgia.[3]

Predisposing causes.—Persons in the prime of life appear most liable to neuralgic affections, from which infancy and old age are generally supposed to be equally exempt. As far as regards protracted age this opinion is certainly well founded; it is not uncommon for patients who have been tortured by the disease for a long series of years, to enjoy an entire cessation from it in the decline of life, a calm rendered more grateful from the remembrance of former sufferings. At a late period of life, the nervous system becomes less susceptible to impressions, and the blunted sensations seem incapable of responding to the excitement which at an earlier age was sufficient to produce the disease. Yet neuralgia, even in its severest forms, is not unknown among old people. Thouret has recorded the case of a lady aged eighty-five, who had been subject to facial neuralgia upwards of thirty years. Another lady, mentioned by the same author, was attacked with this disease at the age of seventy-eight.[4] Dr. Haighton has detailed a case of facial neuralgia, occurring in a lady seventy years of age.[5] Similar instances are given by other authors.

It may be doubted, also, whether infancy is so free from the complaint as is generally imagined; the transient but severe pains so frequent in early life, and which are commonly described as griping, bear a close resemblance to visceral neuralgia. Other forms of the complaint are also occasionally met with in children, as in the following case.

In July, 1833, a little girl aged two years, with every appearance of good health, was brought to me, presenting the following symptoms:—She was seized about four times a day with severe pains of the left side of the face; these paroxysms continued a few seconds only, during which the head was drawn towards the affected side; she seemed to be aware when an attack was approaching, for she then left her playthings and ran to her mother, crying, as if afraid; —tenderness was evinced on pressure over the upper cervical vertebræ; leeches were applied to the spot, and a quinine mixture prescribed, under which treatment she recovered.

[1] Case II. [2] Case III. [3] Cases IV. V.
[4] Histoire de la Societé Royale de Médicine, vol. II.
[5] Medical Recollections and Researches.

M. Coussays observed neuralgia of the sciatic nerve in a little boy seven years of age.

The predisposition to neuralgia is so strong in some habits, that the most trivial accident is sufficient to give rise to the complaint. It attacks most frequently persons of the nervous temperament, and all agents which tend to develope that temperament, more or less contribute to induce it. Thus, it attacks females more frequently than males, and prevails more among the inhabitants of crowded cities, than of country districts. Like other nervous affections, it is observed more commonly among refined and highly civilised communities.

The disease is also supposed to be more prevalent among the rich and luxurious. Frank[1] says that during a practice of several years, he did not meet with a single case at the hospital of Leipsic; whilst, during the same period, he treated several cases among the wealthy inhabitants of that city. This may lead us to attribute the disease sometimes to plethora, particularly as it is observed to be aggravated by other agents having a tendency to promote that condition, such as suppression of accustomed discharges, inactivity, &c.

But neuralgia is no stranger in the abodes of misery and destitution, at least in this metropolis; it is indeed often induced by causes which have a tendency to debilitate the system, such as mental anxiety, want of sleep, impure air, imperfect nourishment, abuse of spirituous liquors, and the like.

There appears also to be an hereditary predisposition to this complaint, for it has been observed to attack patients whose parents had previously been affected with it, or in whose families insanity, epilepsy, or some other disease of the nervous system had prevailed.

Besides this general predisposition to neuralgic affections, there is another question connected with this subject, namely, whether there is any peculiar tendency in particular parts to become affected with it, especially in cases where the pains appear in situations remote from that where the irritation is applied, or wander, apparently without observing any rule, from one organ to another.

In the case of John Cummin,[2] the pain invariably flew to that organ which was in a fatigued state, attacking the legs after a long walk, the arms when he had been working hard, &c.; and in Dillon,[3] the mammæ became affected immediately prior to the menstrual periods.

This disposition of the disease to wander may often be observed where any irritation has been excited by means of blisters, issues, or by any accidental circumstance, in parts remote from the seat of pain. When this occurs, the complaint very commonly vanishes from its original situation, and attacks that which has in this manner been prepared, as it were, to receive it.

[1] Praxeos Medicæ Universæ Præcepta.
[2] See Case vi.
[3] See Case vii.

A curious example of this kind has been given by Hoffmann, in a patient who was subject to severe pains about the neck and scapula, for which a vein was opened in the left foot; immediately after the operation, the pain of the neck and shoulder began to remit, but the patient experienced the most excruciating suffering in the leg. Commencing at the toe, it extended over the foot as far as the knee, although no lesion was discernable externally.[1]

Instances of this occurrence are also mentioned by Siebold, Gunther, and others, where the neuralgia left its former seat, upon the establishment of some fresh irritation in a distant part.

These facts seem to warrant the opinion, that a local predisposition exists in the parts affected with neuralgia, and that the tendency of the disease to change its seat, is totally unconnected with any peculiarity in the nature of the exciting cause.

The character of the pain itself, as to whether it be diffused, lancinating, &c., is also probably determined by some peculiar predisposition in the part where it is situated. I have observed, in many cases, where the pain is diffused, that there is remarkable tenderness of the integument.

Exciting causes.—It is a most important consideration in the study of neuralgic affections, to examine into the nature of the exciting causes: these are so numerous, and so various, that a single glance will be sufficient to show the fallacy of those theories which trace all cases to one common origin, an error, however, into which some able practitioners have fallen.

Exposure to wet and cold, particularly to a stream of cold air, is a frequent cause of neuralgia; thus it is often occasioned by sitting at an open window or door, by insufficiency of clothing in inclement seasons, &c.

Thouret gives a case of a gentleman, who was first attacked with facial neuralgia (with which he was afflicted for several years) after exposure to a snow storm, where the wind beat violently against his face.

In Clerk[2] the complaint originated from the same cause; and, indeed, patients very commonly attribute the commencement of their sufferings to cold. I recollect some cases, which appear to have arisen from the long continued application of cold to a part, as from sitting at an open shop window for many hours of each day, or in a counting-house, exposed to draughts of cold air. In these cases, the complaint was not induced immediately or suddenly, for the patients had pursued the same avocation for several years, without experiencing it, and sometimes had retired altogether from the employment before their sufferings commenced.

Cutaneous irritation.—Neuralgia may be occasioned by irritation applied to the surface of the body, as from cutaneous eruptions, contusions, cicatrices, &c. The pains which accompany the herpes

[1] F. Hoffmann, Consult. et Respons. Med.
[2] Case VIII.

zoster are an example of this; and it is remarkable that they are often exceedingly severe before any sign of the eruption can be distinguished. This fact is of importance, inasmuch as it seems to establish the principle, that simple congestion, or an unnatural determination of blood to an organ, is sufficient to cause some neuralgic diseases; the pain continues, however, during the eruptive stage, when the paroxysms are excited by every circumstance which increases the heat of the surface, nor do they in every case subside immediately after the cutaneous affection has disappeared.

In a similar manner, the irritation from a leech bite sometimes causes neuralgia, as in the following case:—

A gentleman, aged twenty-five, had an exceedingly irritable bubo in the left groin, to which leeches were applied; two days afterwards, he was awakened about four o'clock in the morning with acute lancinating pain, proceeding from one of the leech bites, and extending over the surrounding skin; the pain was entirely superficial, and was of a different character from that of the bubo; after continuing about three hours, the paroxysm terminated suddenly; it did not return on the following day, but on the second morning, precisely at the same hour, the attack was renewed, and continued about the same time as before. The bubo subsequently became more indolent and less painful, and the neuralgic affection disappeared.

Several authors have related cases of neuralgia which arose from contusions; and some well authenticated facts are recorded, where the disease proceeding from this cause continued for months, and even years after the accident, and where the symptoms have been subsequently proved to originate in this manner, by their immediate subsidence upon making a crucial incision over the contused part.

Pouteau relates the case of a young man who received a kick on the tibia, which shortly afterwards was succeeded by severe pains, extending from the thigh to the leg and foot; this pain continued for many years, and was finally removed by making a crucial incision over the affected part.[1]

Larrey had a patient who was attacked with severe facial neuralgia, subsequently to receiving a blow with a foil, over the course of the infra-orbitar nerve.[2]

In Elizabeth Hawker,[3] the complaint seems to have had a similar origin: she was attacked with severe pains of the sides of the neck and temples, which she attributed to a severe blow received upon the scalp, in falling against a grate six months previously.

The disease has, in some instances, been traced to the irritation arising from an old cicatrix. "We find cases (Dr. Bright observes) which lead us to believe that tic-douloureux sometimes originates in affections of the extremities of the nerves, and may be derived

[1] Œuvres posthumes. [2] On the Use of the Moxa. [3] Case ix.

from wounds of fleshy parts, and cured by applications to the cicatrix."[1]

Lentin met with a case of facial neuralgia, which apparently proceeded from a cicatrix remaining after a wound in the face.[2]

Elizabeth Burley, aged sixteen, had suffered for several weeks from acute lancinating pain of the left temple and side of head, for which many remedies had been tried without effect. Upon enquiry into the history of the case, it was discovered that some years ago she had received a severe cut over the right parietal bone, which had been long healing, and that this spot had always been tender since the accident. When the hair was removed, a large uneven cicatrix was observed; a blister applied over this spot relieved the pain for several weeks, when it again recurred. After trying various remedies, it was proposed to make a crucial incision through the cicatrix, but the patient refused to submit to the operation, and soon afterwards discontinued her attendance.

The neuralgia does not always, in cases of this description, occupy the actual seat of the injury, but is often at some distance from it.

Overstretching of nerves.—Neuralgia is sometimes produced when a limb is kept forcibly extended for a considerable period. Wormald's case[3] is a curious example of the disease originating from the suspension of a heavy weight to the left arm during several minutes; and it is worthy of remark, that the pains were felt with equal severity in the lower extremities as in the upper.

A lady riding on horseback, was nearly thrown from her seat by a sudden start of the animal;—a gentleman, by whom she was accompanied, seized her arm, and suspended her by it for several seconds; immediately afterwards, she began to suffer acute lancinating pain in the fore-arm.[4]

The neuralgia which follows excessive fatigue is probably induced upon a similar principle.

A French conscript, after making great efforts to escape from the gens d'armes, by whom he was pursued, was attacked with excruciating pain in the course of the sciatic nerve, which was subsequently discovered in a state of inflammation.[5]

A medical student, who had made great exertions in swimming, experienced stiffness in the arms and shoulders, which continued several days. When this symptom had nearly subsided, he was attacked with paroxysms of acute lancinating pain, which darted from the spine of the left scapula towards its inferior angle. It was not increased on pressure, and was unattended by heat or swelling. About three paroxysms occurred daily, and continued about two or three hours.

[1] Bright's Medical Reports.
[2] Blumenbach, Med. Chir. Bibl.
[3] See Case x.
[4] Piorry, Clinique Médicale.
[5] Martinet, Revue Médicale, 1824.

Pressure of nerves.—Neuralgia is often the consequence of the pressure of a nerve by a foreign body, an enlarged organ, the dilatation of a vessel, tumour, &c.

There is, for instance, a particular species of tumour (commonly described as the subcutaneous tubercle) which is characterised by being exquisitely tender to the touch, and occasioning pain in every respect similar to neuralgia; these little tumours sometimes escape detection, or, at least, may not be discovered until the patient has undergone many years of torment, and has been wearied by the trial of unavailing remedies; they are situated immediately beneath the skin, and are met with in all parts of the body, but most commonly in the extremities;—they have sometimes been found connected with, or separating and stretching, minute nervous fibrillæ. Mr. Swan removed a tumour of this description, in which "a cutaneous nerve was seen passing between it and the skin, and an expansion of the nerve was spread over it."[1] In general, however, these tumours appear to have no direct communication with nerves, or, at least, none that can be traced by means of the scalpel. They differ in size, from a millet-seed to a small pea; their sensibility varies at different periods, for they may sometimes be examined and pressed without occasioning much suffering, whilst at others, the slightest touch induces a paroxysm, in which the pain either radiates in all directions around the tumour, or darts along the track of one or more nervous filaments.

Dupuytren, in his lectures, observed that all the tumours of this description that he had witnessed had a remarkable resemblance to each other, being composed of an envelope of cellular tissue, loosely attached and easily removed, and, beneath this, a substance of a fibro-cartilaginous nature, having the colour and texture of a dried pea, without any hollow in its centre, and so extremely elastic, as to rebound actively when dropped upon the ground.

Sir Astley Cooper also describes them as "composed of a solid and semi-transparent substance with fibres interwoven in it, but without any regular distribution."[2]

In some instances, they seem to be formed with great rapidity. A woman under my care for another affection, perceived one of them on the side of the leg, which she was confident had appeared within a few days.

They seldom subside spontaneously; one example only of this occurrence is mentioned by Descot, which was in the person of the celebrated Beclard. When he was a student at Paris, a hard tumour, about the size of a grain of wheat, formed in his leg. It occasioned excessive suffering, but disappeared in a few months, upon his removing from an unhealthy apartment, which he had occupied for a considerable period.[3]

The extirpation of these superficial tumours, is generally followed

[1] Swan on Diseases and Injuries of Nerves.
[2] Sir Astley Cooper on Diseases of the Breast.
[3] Descot sur les Affections Locales des Nerfs.

by the complete cessation of the pain; and sufferings which had rendered existence almost insupportable, are instantly terminated by an operation devoid alike of difficulty or danger.

Cheselden removed one of them from the nates, not larger than the head of a pin, which was so exceedingly painful, that the least touch excited dreadful torture. The patient, who could not put his foot to the ground, or even turn in his bed, without the most acute suffering, was immediately relieved by the operation.[1]

Innumerable cases, almost precisely similar to the above, have been recorded by various authors; but it would be tedious to dwell further upon this topic.[2]

Other tumours are also found adhering to nerves or embedded between their fibres, exciting acute pain, which darts along the course of their filaments. They are composed either of a solid substance, or of a cyst, containing gelatinous matter, and "vary in size from a grain of wheat to a substance of considerable magnitude."[3]

Carious Teeth.—Among the causes of neuralgia, the influence of a carious tooth in producing the disease cannot escape notice. It is generally supposed to act by irritating the branches of the fifth pair; but it is important to recollect, that nerves in all parts of the body may become affected from the same cause.

A man, aged seventy, suffered severe pain in the left shoulder, which extended along the inside of the arm; it subsequently quitted that situation, and flew to the heart, retaining its lancinating character. After alternating between these two situations for several months, it finally attacked the first molar tooth, in which, upon a close examination, a deep caries was discovered, which had been previously overlooked; the tooth was immediately extracted, and the symptoms subsided.[4]

Mr. Bell met with a similar case, in a gentleman who had for some time suffered from a neuralgic affection of the right arm; the paroxysms were subsequently observed to commence with pain in the second molar tooth, and to be excited whenever it was pressed or otherwise irritated. Upon the removal of the tooth the pain disappeared.[5]

Neuralgia from disorders of the alimentary canal.—The difference of opinion which prevails, even among eminent pathologists, respecting the frequency of the disease, arising from this cause, is truly remarkable: it is maintained by many, that the greater number of cases depend upon gastric or intestinal irritation; whereas Montfalcon,[6] Dr Elliotson,[7] and some others believe that there are no just grounds for this opinion.

[1] Cheselden's Anatomy.
[2] See Dr. Marshall Hall on Diagnosis;—Wood, Edin. Med. and Surg. Journal, vol. viii.—Descot Sur les Affections Locales des Nerfs.
[3] Mayo's Pathology.
[4] Piorry Clinique Médicale.
[5] Bell on the Anatomy, Physiology, and Diseases of the Teeth.
[6] Montfalcon, Dictionnaire des Sciences Médicales, art. Neuralgia.
[7] Elliotson, Cyclopedia of Practical Medicine, art. Neuralgia.

These totally opposite sentiments, among persons so well qualified to judge upon the subject, sufficiently attest the difficulties that attend its investigation; there are, in fact, several sources of error, which it is necessary for the practitioner to examine before he decides that gastric disorder is the origin of a neuralgic affection.

In the first place, when dyspeptic symptoms and neuralgia occur together, it is not always an easy task to determine which of these disorders ought properly to be regarded as the original one; for in neuralgia, especially in protracted cases, from whatever cause they may arise, the stomach generally participates sooner or later, in the disturbance occasioned by the excessive, and almost constant suffering.

In such cases, it would be easy to mistake for the cause of the disease, a condition which is one of its natural consequences. Even when the paroxysms of neuralgia are excited or calmed, accordingly as the digestive functions are healthily performed or otherwise, the evidence of a gastric origin is still incomplete.

When neuralgic symptoms disappear, after the long continued employment of purgative medicines, this circumstance alone, will not be sufficient to prove that the complaint was produced by the accumulation of irritating matter in the intestinal canal, for this remedy may also act as a derivant from the brain or spinal marrow.[1]

But allowing these considerations their due importance, and weighing cautiously the evidence, it is impossible, I think, to refuse assent to the opinion, that irritation of the primæ viæ is capable of exciting the disease; in many cases this evidence is as direct and positive as it is possible to arrive at in reasoning upon medical subjects.

Innumerable cases are recorded where neuralgic attacks have been suddenly excited by the presence of indigestible food in the stomach, and have as suddenly disappeared upon its rejection, in patients not subject to the disease, and where no other cause for the malady could be discovered.

The passage of cathartic medicine produces neuralgic pains in some habits. Mr. Swan was acquainted with a gentleman, in whom pains of the fingers were excited whenever he had a motion.[2] The irritation of the intestines in consequence of worms also gives rise to neuralgic pains, which cease immediately upon their expulsion.

Sir B. Brodie mentions the following circumstance of the late Dr. Wollaston. He ate some ice cream after dinner, which his stomach seemed to be incapable of digesting; some time afterwards, when he left the dinner table to go to the drawing room, he found himself lame from a violent pain in one ankle. Suddenly he became sick; the ice cream was rejected from the stomach; and this was followed by an instantaneous relief of the pain in the foot."

The following remarkable case is from the same author.

[1] Alison. Hist. of Medicine in Cyclo. of Pract. Medicine.

[2] Swan, l. c.

"A gentleman awoke in the middle of the night, labouring under a severe pain in one foot; at the same time that some other sensations, to which he was not unaccustomed, indicated the existence of an unusual quantity of acid in the stomach. To relieve the latter, he swallowed a large dose of an alkaline medicine. Immediately on the acid in the stomach having been thus neutralised, the pain in the foot left him."[1]

The more serious disorders of the intestinal canal may also prove the source of the disease. Andral had a patient, in whom it occurred in connection with chronic gastritis, the pains being aggravated or mitigated according to the changes of the gastric affection.[2]

But in many cases there is no reason whatever for attributing the complaint to derangement of the stomach and bowels, for the functions of these organs are often performed with the greatest regularity, and the patients, notwithstanding the severity of their sufferings, retain every external appearance of sound health; moreover, in most protracted cases, the purgative plan of treatment has been repeatedly resorted to, without effecting a cure.

The disease may also be occasioned by disorder of the other abdominal viscera, a familiar example of which occurs in the pains of the shoulder and arm, which accompany disease of the liver.

Neuralgia from diseases of the urinary organs.—The nervous pains arising from this cause are often of a very severe description.

Sir B. Brodie relieved in an instant a distressing neuralgic affection of the foot, by penetrating a stricture of the urethra, and passing a catheter into the bladder.[3]

Mr. Swan mentions a case where pain of the backs of the fingers was induced by evacuating the bladder when much distended.[4]

A patient, whom I saw with Mr. Brown, of St. Mary Axe, complained of severe pain of the right side of the abdomen in the pubic region, simulating peritoneal inflammation; there was also much tenderness over the left kidney, but none whatever over the right. In a post mortem examination, no sign of inflammation could be detected in the bladder or the abdomen; the left kidney, over which the tenderness had been observed, was also perfectly healthy, but into the lower part of the medullary portion of the right kidney, a considerable quantity of pale, cream-like pus was infiltrated.[5]

Neuralgia from disorder of the heart and large vessels.—The manner in which this cause acts in producing neuralgia, varies in different cases. In general it appears, to be the consequence of the disturbance in the distribution of the blood, occasioned by affections of the heart, by which one organ receives more than its natural quantity, whilst another is in a state of anæmia.

In this way neuralgic affections occur, in consequence of increased

[1] Sir B. Brodie, l. c.
[2] Andral Clinique Médicale, vol. ii.
[3] Sir B. Brodie, l. c.
[4] Swan, l. c.
[5] See Abernethy's Lectures, Lancet, vol. vi. 1825.

impetus of the blood to the brain and its membranes, when the action of the ventricle is too great, or of some impediment to the return of the blood to the right side of the heart; or other vessels may become distended from the same cause, and pressing upon their accompanying nerves excite the disease.

Neuralgia of the thoracic parietes, the side of the neck or head, shoulders and arms, especially the left arm, very often arises from the bulk and irregular action of a diseased heart. Frequently, also, the gastric nerves become affected from the same cause; and sometimes the irritation is communicated to the spinal column.

When the disease arises from this cause, it is generally of an irregular type, for the paroxysms are excited by unusual exertion, by mental disturbance, or by any other circumstances which induce inordinate vascular action, and are calmed by rest, and by the remedies which have a tendency to diminish the force of the circulation.

Frequently, severe cases of the disease are connected with aneurisms of the thoracic and abdominal aorta, when the pains are often very circumscribed, and are chiefly felt in the back or extremities.

Mr. Greville Jones removed a large aneurism of the aorta from the body of a man in Islington workhouse, who had been remarkable for the violent lancinating pains he suffered in the chest, and who suddenly fell dead. On minutely examining the state of the nerves, they were found much enlarged, and adherent to the diseased mass. In the drawing which Mr. Jones has been so kind as to show me, the recurrent nerve where it passes behind the aorta, appears of from four to five times the natural size, and it was, of course, stretched by the tumour.

Neuralgia from uterine disorders.—It is to this cause, rather than to any peculiarity of temperament, that the greater frequency of the disease in females is to be ascribed. It is very commonly met with at the first approach of the catamenia, and sometimes, at this period, injuries which had occurred in childhood, and were almost forgotten, become the seat of violent neuralgic pains. Some women suffer from modifications of the disease, at every return of the menstrual period.

A short time ago, a woman came under my care who had suffered from severe facial neuralgia for several years, which appeared and disappeared regularly with the catamenia.

That peculiar form of neuralgia which stimulates visceral inflammation, very commonly originates in uterine disorder.

The uterus may also become the source of neuralgia, by its pressure on the surrounding nerves, when it is enlarged by tumours, or in gestation, or when its displacement has occurred.

Neuralgia from spinal irritation.—The great influence which diseases of the spinal column exercise over the functions of other organs, has been long known to medical practitioners.[1] This

[1] See Dr. Craigie, in his Review of Bradley, on a Stridulous Affection of the Bowels.—Edin. Med. and Surg. Journal, vol. xlv. 1836.

principle of pathology has recently been applied with great success, in tracing the origin of neuralgic affections, by which many highly important observations have been accumulated, where the symptoms of the disease have been found in connection with tenderness over that portion of the spine which corresponds to the origin of the affected nerves, and have been speedily and permanently removed by the application of remedies over that part.

From the works of Pouteau, published in 1785, it is evident that the spinal origin of neuralgia was well understood by that eminent surgeon, but in common with the pathologists of his time, he confounded this disease with others of a more formidable nature; the history of some of the cases described by him under the title of Gibbosité, bear a perfect resemblance to the neuralgia from spinal irritation of modern authors: thus, severe pain in various parts of the body, was attributed by him to an affection of the spine, denoted by tenderness, on pressure, over a small portion of that organ. The remedies were directed to the central source of irritation, and consisted chiefly of the application of moxas to that spot. By this means he cured many cases which had previously resisted every other mode of treatment.[1] This source of painful nervous affections is also distinctly alluded to in the work of Dr. Bradley,[2] and in a communication by Mr. Player.[3]

The publication, however, which appears to merit the reputation of having directed general attention to this subject, is an excellent paper of Dr. Brown's, of Glasgow, published in the Medical Journal of that city, in 1828. In the following year, a paper appeared from the pen of Dr. Darwall, of Birmingham,[4] and, subsequently, a work by Mr. Teale of Leeds,[5] the latter of whom, in particular, detailed many cases, in which various forms of neuralgia were found connected with spinal irritation. Since that time, several other practitioners have published the result of their experience on the same subject.[6]

It is remarkable, that in this kind of neuralgia, the patient seldom complains of pain in the back, except when the spine is examined, either by pressing each vertebra successively, or, as some prefer, by applying a sponge, dipped in hot water, along the course of the spinal column. When this process is adopted, tenderness is immediately manifested, by the patient shrinking from the examination as soon as a particular spot is touched, and dreading its repetition; in general, the tenderness is confined to one vertebra only, but it sometimes extends to two or more, and occasionally two distant vertebræ are simultaneously affected, whilst the intervening space

[1] Pouteau's Œuvres Posthumes.

[2] Dr. Bradley, l. c. See c. xiii. on Spinal Disease, unaccompanied with change of structure.

[3] Quart. Journal of Science, 1821.

[4] Midland Medical Reporter.

[5] A Treatise on Neuralgic Diseases.

[6] See Griffin. Observations on Functional Diseases of the Spinal Cord.

remains free from pain. Sometimes, also, pressure over one portion of the vertebral column excites pain in another and distant portion of it. The tenderness frequently disappears suddenly from a part of the spine where it had been first observed, and fixes itself in another which had previously been free from it. The irritation is not generally perceived over the spinous processes of the vertebræ, which may be pressed with some force, without any pain being excited, whilst exquisite suffering is produced when the pressure is applied over the sides of the vertebræ.

The evidence in proof of the dependence of nervous pains upon that condition of the organ and the nerves which is indicated by spinal tenderness, is sufficiently direct and satisfactory. There is a constant relation between the seat of the pain and the vertebra where the tenderness is observed. Thus, when the irritation is over the cervical region of the spine, the neuralgia will be felt in the scalp, neck, and temples; tenderness over the dorsal vertebræ is accompanied by pains of the upper extremities and thorax; when it is perceived over the lumbar vertebræ, the neuralgic affection attacks the pelvis and lower extremities. Similar observations have been made in cases of internal neuralgia, where the tenderness is found over that portion of the spine where the nerves which communicate with those of the affected viscera take their origin. Further proof of this connection is derived from the paroxysms being produced whenever the tender portion of the spine is firmly pressed, and by the subsidence of the symptoms upon the application of remedies to that situation.

Respecting the nature of spinal irritation, little more than conjecture has hitherto been advanced.

Pouteau supposed that it arose from an irritating fluid applied to the spinal nerves.

Dr. Brown suggests, that it might depend "upon the spasm of one or other of the muscles arranged along the spine, altering the position of the vertebræ, or otherwise compressing the nerves, in their issue from the spinal marrow."

Dr. Darwall is inclined to believe, "that in most cases, there is some irregularity in the local circulation; that there is frequently congestion, and it may be conceived, that it will sometimes proceed into acute or chronic inflammation."

Mr. Teale is of opinion, "that it consists in the lighter shades of inflammation, seldom attaining those violent degrees of intensity which are attended with obvious disorganization."

There can be no doubt that each of the above morbid conditions, considered by their respective authors as the proximate cause of this kind of neuralgia, would be attended by pain in those organs deriving their nerves from the affected portion of the spine; but the history of spinal irritation contains facts which cannot be explained upon either of those hypotheses;—indeed, there are good reasons for believing, and in some instances there is satisfactory proof, that spinal irritation is not generally dependent upon any primitive affec-

tion of the spine whatever; for it is not attended with febrile excitement, and is often observed to remove suddenly from one portion of the spine, and appear in another. The irritation may be continued for an indefinite period, without occasioning symptoms of an alarming nature; and when an opportunity is afforded of making a post mortem examination, dissection reveals no alteration of structure in the affected parts; moreover, several of the facts connected with this subject, favour the opinion that spinal irritation is not, generally, an idiopathic disorder, but that it is merely the consequence, and the index as it were, of morbid action in other organs.

In Dillon,[1] an injury of a branch of the radial nerve was followed, in a few days, by pain extending upwards along its course, and excessive tenderness over the spinal column; shortly afterwards, a new set of symptoms appeared, evidently connected with the vertebral tenderness, consisting of darting pains of the arms and thorax, and especially of the left mamma. These pains all vanished upon the appearance of the catamenia, and the spinal tenderness could no longer be detected; but it re-appeared as the menstrual period again approached, and was accompanied by the same train of symptoms as before. A course precisely similar was repeated for several successive months, except that the severity of the pains diminished as the wounded nerve recovered.

That the spinal irritation was in this instance the effect of the injury to the nerve, appears certain, from its supervening soon after the accident, growing less and less apparent as the wound healed, and finally disappearing, without any remedy to the spine.

It is probable, had the nerve been divided above the injury in this case, that the spinal tenderness, and the neuralgia emanating from it, would have instantly vanished. This conclusion seems warranted by the results which have followed the division of wounded nerves, under similar circumstances.

The following passage from Ludwig will show that he was well acquainted with the spinal irritation and the nervous pains connected with it, proceeding from disorders of the intestinal canal.

He says, "We must speak of colic pains, which affect not only the colon, but also the other intestines with troublesome tension; for the mesenteric plexus, in descending along the aorta, are so fixed to the spine of the back, that they appear as if agglutinated to it anteriorly, so that not only do they occasion wandering spasms in various parts of the intestinal canal, but involve also the lumbar portion of the spine; and it often happens, that the neighbouring sides become painful, whilst the spasms ascending to the chest and ribs, frequently simulate pleuritic pains, which, however, are instantly allayed when the cause of the intestinal spasms has been removed by fit remedies."[2]

[1] See Case VIII.

[2] "Dicamus autem primum de colicis doloribus, quippe qui non solum zonam coli, sed reliqua quoque intestina tensionibus molestis afficiunt. Plexus enim mesaraici, ad aortam descendendo, adeo ad spinam dorsi

Dr. Greaves has given a striking example of the occurrence of spinal tenderness in consequence of gastric disorder, where both affections were cured by means of remedies applied to the epigastrium.[1]

The dependence of spinal irritation upon affections of other organs, is sometimes less apparent where a careful examination is nevertheless sufficient to demonstrate it. The investigation should not be regarded as completed, even when the nervous pains have been clearly traced to irritation of the corresponding portion of the spine; but, in every case, the whole length of the vertebral column should be examined. By observing this rule, similar tenderness will often be detected over some other portion of the spine, where it is evidently dependent upon visceral derangement or external injury. There is, therefore, the primary disorder, causing irritation of the portion of the spinal column immediately connected with it; subsequently the communication of the irritation to other parts of the spine, and the neuralgic paroxysms emanating from the latter. That the whole of this train of symptoms is intimately connected, may be shown, by pressure over the lower portion of the spine sometimes exciting pain in the dorsal or cervical regions, or (which is more common) occasioning the neuralgic paroxysms. Further proof of this connection is afforded by the disappearance of the spinal irritation and the nervous pains, when the treatment is directed solely to the relief of the primary disease.[2]

The spinal tenderness, however, does not always subside upon the removal of the disorder in which it originated, nor does the neuralgia always cease when the irritation which was its central source can no longer be detected; but, under each of those circumstances, the symptoms are generally mitigated, and are reduced to a condition more favourable to the action of remedies.[3]

With regard to the frequency of neuralgia from spinal irritation, my opinion does not coincide with the experience of some recent authors, for, in the majority of cases, I have not been able to detect any sign of tenderness over the vertebral column; I have the authority of Dr. Alison for stating, that he has arrived at the same conclusion.

Neuralgia from organic diseases of the brain and spinal marrow.—The species of neuralgia most commonly observed, in connection with structural diseases of the brain, is that of the cere-

adhærent, ut eidem anterius quasi agglutinati videantur, ideoque non solum vagos spasmos in variis tubi intestinalis partibus efficiunt, sed spinam dorsi lumbarem, etiam in consensum trahunt. Sæpius ita accidit, ut vicina latera simul dolerent, et spasmi ad thoracem, et costas ascendendo, pleuriticos sæpe dolores mentirentur, qui tamen protinus compescuntur, quando causa spasmorum intestinalium, idoneis remediis discussa est.—Ludwig Adversaria Medico Practica.

[1] London Med. and Sur. Journal, vol. iii.

[2] Cases xii and xiii.

[3] Cases xiv and xv.

bral nerves, of which several examples have been recorded by authors. But it is by no means unusual to observe other forms of the disease depending upon this origin. Sometimes the pains are felt in the region of the stomach or liver, or some other internal organ, whilst the cerebral symptoms are either altogether absent, or are so slight, that they are regarded as merely of a secondary character. In other cases, neuralgic pains of an external organ, occupying a limited surface, or darting in the course of a nervous filament, form the chief or only symptom, although the subsequent history has proved the existence of organic disease of the brain.[1]

Andral observed a case, where nervous pain of the extremities was the only symptom during several months, of what was subsequently proved by dissection to be softening of the brain.[2]

It is well known, that nervous pains of the trunk and extremities commonly attend the progress of organic affections of the spinal column, which, in the earlier stages, is often the only complaint for which the patient seeks to be relieved.

A patient in Bartholomew's hospital, complained of severe pain of the knee, which proved so obstinate, that amputation was performed. Some years afterwards, an opportunity of examining the spine was afforded, when thin plates of cartilaginous and bony deposits, were found in the posterior surface of the cord.[3]

In Gregory's[4] case, the progress of the spinal disease was very insidious, the principal symptoms being lancinating pains of the extremities, and even these were for several months entirely suspended. Subsequently, when fulfilling his duties as a watchman, he received a slight injury; upon which the nervous pains were instantly renewed, and were now attended by other symptoms, more clearly indicating the existence of organic disease. The post mortem examination exhibited a portion of the spinal marrow in a softened state.

Neuralgia from malignant diseases.—The dreadful lancinating pains which attend the progress of malignant disease, appear to be of the nature of neuralgia, and may sometimes be temporarily relieved by the mode of treatment found most efficacious in that affection.

Neuralgia from chronic inflammation.—Neuralgia may also appear in parts affected with chronic inflammation. The paroxysms are often observed to be periodical under such circumstances, and the pain is perfectly distinct, and of a different character from that which ordinarily attends chronic inflammatory affections. On this subject, Dr. Alison remarks, "These pains, although hardly ever observed during violent inflammatory diseases, are by no means

[1] See Abercrombie, Pract. and Pathog. Research, on Dis. of the Brain and Spinal cord, p. 324.

[2] Andral, Clinique Médicale, vol. v.

[3] Mayo's Pathology.

[4] Case xvi.

incompatible, but, on the contrary, frequently combined with such inflammation as is subacute or tends little to disorganisation in the parts where they occur. Even in that case, however, they retain their character in some degree, and are benefited only partially by the antiphlogistic, and often chiefly by the more specific remedies subsequently used."[1]

Neuralgia from syphilis.[2]

Neuralgia from rheumatism.[2]

Neuralgia from inflammation of nerves.[2]

Neuralgia from malaria.—In consequence of the striking resemblance between the phenomena of neuralgic paroxysms and those of ague, Van Swieten used the name of febris topica, which he supposed to be of a nature similar in every respect to intermittent fever, differing only in the amount of morbid action, which in the one case is confined to a single spot, whilst in the other the whole system is under its influence.[3]

Sauvages, in his nosology, describes a species of sciatica, which he calls ischias intermittens. This species, he says, arises from the same cause as agues, and assumes the same types.

The same opinion is clearly expressed by M. Coquereau, who published the history of a periodical headache that prevailed in Paris in 1778.[4] These headaches, he remarks, are nothing more than local intermitting fevers, arising from the same cause as ordinary intermittents, and requiring a similar treatment.

The late Dr. Macculloch, who investigated the subject of malaria with great ingenuity and success, was of opinion, that by far the greater number of neuralgic cases originated from that source, and that the poison is frequently generated in localities where its presence has never been suspected.[5]

Among the facts which are supposed to prove the agency of this cause in the production of neuralgia, the following are worthy of particular notice:—the disease is very prevalent in marshy districts; the paroxysms are sometimes observed to commence with a sensation of cold, either general or local, which is succeeded by an elevation of the temperature of the affected part; they often return with the greatest regularity at stated periods, assuming the types common to intermittent fevers. Neuralgia frequently co-exists with ague in the same individual, and sometimes alternates with it; and the same mode of treatment is applicable to both affections.

The periodical character alone cannot, however, be relied upon as establishing the miasmal origin of neuralgia, for this tendency is also observed in cases which have obviously no connection with malaria. The explanation of the phenomena belongs rather to the

[1] Alison's Outlines of Pathology.

[2] See Pathology of Neuralgia.

[3] Van Swieten, l. c.

[4] Histoire de la Societé Royale de Médicine.

[5] Macculloch on the Production and Propagation of Malaria.

general theory of nervous action, than to any thing specific in the nature of the exciting cause.

John Hunter relates two cases of severe pain of the side of the face, in which the paroxysms were perfectly regular, although the disease was afterwards found to depend upon a dens sapientiæ piercing the gum.[1]

Dr. Darwin, speaking of hemicrania, says, "A remarkable circumstance attends this kind of headache, viz. that it recurs by periods, like those of intermittent fevers; these periods correspond with alternate lunar and solar days, and that even when a decaying tooth is evidently the cause, which has been evinced by the cure of the disease by the removal of the tooth.[2]

The same tendency to assume a periodical type, has been remarked when the disease arises from an injury of the nerve itself, or from its pressure in consequence of an aneurism or tumour; in organic affections of the brain, &c.

Neither can it be adduced in proof of the malarious origin of neuralgia, that the paroxysms commence with a sensation of cold, either local or general; for this symptom also is often present when the disease arises from other causes.

The disease may, however, be suspected to originate from this cause, when it appears as an endemic in marshy districts, or even when it occurs in insulated dwellings, situated in the vicinity of marshes, stagnant waters, or of sluggish rivers and canals; or when the patient has visited, or even passed through a malarious district, and when the disease appears or renews its attacks in spring and autumn.

Neuralgia from anæmia.—An insufficient supply of the circulating fluid has already been mentioned among the predisposing causes of the disease, but there can be no doubt that in some cases it must be regarded as the exciting cause. It has been well ascertained, that when an organ is deprived of its due quantity of blood, its functions become disturbed, and, among other symptoms, pain may be excited. Thus, when an artery has been tied for aneurism, the parts to which it conveyed blood often become extremely painful; after hemorrhages, violent pains frequently arise in different parts of the body, sometimes simulating inflammation of a vital organ. It is probable, also, that the wandering pains that are so common in chlorotic cases may arise from a similar cause; namely, a deficiency of the circulating fluid, which is one of the most remarkable characters of that disease. This opinion derives further support from the sufferings being generally alleviated by remedies that have a tendency to give tone to the circulation, and to induce a plethoric state of the system.[3]

When epilepsy, hypochondriasis, hysteria, &c., accompany neu-

[1] John Hunter. Natural History of the Human Teeth.
[2] Darwin's Zoonomia.
[3] See Dr. Marshall Hall, on the effects of Loss of Blood.

ralgia, they cannot be regarded as its exciting cause; for these diseases, as well as neuralgia, are equally the consequence of morbid action in some portion of the nervous system, and may all result, either separately or in combination, from the same cause.

For instance, when an injury of a nerve excites pain along its course, and terminates in a paroxysm of epilepsy, or when disorder of the uterine functions occasions symptoms of neuralgia, together with that peculiar nervous excitement which is termed hysteria,—in these cases, and in every other where this complication is observed, there must exist some previous source of irritation, to which all the symptoms may be referred. There is, in fact, no more reason for believing that the epilepsy or hysteria is the cause of the neuralgia, than that the latter is the source of those other nervous affections.

Seat of neuralgia.—The remarkable precision which neuralgia often observes, in following the course of a nervous branch, sometimes through all its ramifications, naturally suggests the opinion, that it proceeds from some disorder of the nerve itself; and this view is further supported by the nature of the pain being similar to that occasioned when a nerve is irritated.

That it is a disease strictly confined to the nervous system, is confirmed by several pathological observations. It is produced, whenever a stimulus is applied to a sentient nerve, either at its origin, or in any part of its course; it may be occasioned by certain causes which act solely upon nerves without implicating any other tissues, such as a tumour pressing on a nerve; whilst the same causes do not excite the disease, when applied to any tissue except the nervous, unless the irritation be continued long enough to be communicated to the latter. Lastly, the section of a nerve affected with neuralgia, under favourable circumstances, is immediately followed by the cessation of the pain, which is again renewed when the two extremities of the divided nerve reunite.

The nerves most affected with the disease are those which are commonly classed as nerves of sensation, namely, the ganglionic portion of the fifth pair of cerebral nerves, and those which arise from the posterior column of the spinal cord.

Previous to the experiments of Sir C. Bell,[1] for the purpose of illustrating the functions of the portio dura of the seventh pair, neuralgia of the face was generally supposed to be an affection of that nerve. But that physiologist has proved, that the functions of this division of the seventh pair are chiefly connected with muscular motion, although many practitioners of eminence still doubt whether this nerve may not occasionally become affected with the disease; and by some this opinion is strongly maintained.

It is, indeed, perfectly consistent with physiology, that the portio dura may, to a certain extent, become a nerve of sensation, upon the application of an irritant, for Sir C. Bell has observed, that

[1] Bell. Exposition of the Natural System of the Nerves.

"branches of the fifth, or sensitive nerve, join and incorporate with the portio dura, so that the nerve, when cut anterior to this juncture, must exhibit signs of sensibility." How far this sensibility may be augmented by disease, appears to be still undecided.

Several cases have been published, where the pain seemed to follow the course of the portio dura, and was, moreover, accompanied by convulsive twitchings of the facial muscles, and in some instances, by their paralysis; facts which prove at least that the functions of this nerve were disturbed.

A lady, aged forty, had experienced for several months intolerable pains in the right side of the lower jaw, which where exasperated towards night: these pains commenced at the stylo-mastoid foramen, beneath the ear, and extended over the corresponding side of the face to the mouth, which was then affected with slight spasmodic twitchings. The pain was similar to that occasioned by striking the ulnar nerve at the bend of the elbow, and seemed to stretch from the trunk of the facial nerve to its most minute filaments. The right commissure of the mouth was slightly drawn outwards and upwards.[1]

A lady, aged thirty-seven, suffered acute pain in the gums, which was attributed to decayed teeth. The painful sensation commenced at the point where the facial nerve emerges from the stylo-mastoid foramen, and extended to the temporal region—the cheek, the lips, and the upper part of the neck. The mouth was slightly turned towards the affected side.[2]

These cases (to which others might be added) are considered by the authors who observed them, as examples of neuralgia of the portio dura; but there is reason to doubt the accuracy of their diagnosis, which is considerably weakened by a case of this kind mentioned by Thouret, where the pains apparently followed the ramifications of the portio dura, commencing at the stylo-mastoid foramen, and spreading over the cheek. With the hope of effecting a cure, the facial nerve was divided at its exit from the craninm, but no mitigation of the sufferings followed; and the only result of the operation was paralysis of the muscles of that side of the face.[3]

It must, therefore, still be considered doubtful, whether this nerve is capable of being affected with neuralgia. The onus probandi certainly rests upon those who maintain the affirmative, because their opinion is contrary to what might naturally be concluded from the acknowledged functions of the nerve.

May not the portio dura, which forms connections in the muscular parts with the extreme branches of the fifth nerve, become the medium for the communication of neuralgia to the sentient nerves of the face from an irritant applied to it, in the same manner

[1] Piorry, Clinique Médicale.

[2] Ribes, Observation de Névralgia du Nerf Facial. Magendie's Journ. de Physiol. vol. ii.

[3] Histoire de la Societé Royale de Medicine, vol. ii.

that the great sympathetic transmits to sentient nerves the irritation which originates in disorders of the primæ viæ?

It is still disputed, whether the sympathetic nerve and its ganglia are endowed with sensibility, and, consequently, whether visceral neuralgia is an affection of that system of nerves, or of the cerebro-spinal. From the experiments of Haller, it would appear that irritation of the ganglionic system induces obscure signs of sensibility, although of a kind infinitely below that manifested when a branch of the cerebro-spinal is touched.

Bichat says, "I have watched that state which succeeds the agitation caused by the incision of the abdominal parietes, then I have laid bare the semilunar ganglion, and have strongly irritated it; the animal was not agitated: whilst as soon as I irritated a cerebral or lumbar nerve, he cried, struggled, or attempted to rise."[1]

This celebrated physiologist, however, believed, that in a morbid state the sensibility of the ganglionic nerves becomes considerably increased, and that they are the seat of certain colics which constitute the real neuralgiæ of the nervous system of organic life.

Magendie has taken a very different view of this question; he observed, in the course of his physiological experiments, that the sympathetic ganglia were cut and irritated without any manifestation of suffering by the animal. He therefore concludes that these ganglia do not possess sensibility, and even denies their right to be classed as forming any portion of the nervous system.[2]

A series of vivi-sections, for the purpose of elucidating the functions of the ganglionic nerves, has recently been instituted by M. Brachet,[3] in which the question as to their sensibility was made one of the subjects of enquiry.

He found that the sympathetic ganglia and the filaments which proceed from them, might be repeatedly pricked, without any sign of suffering being shown by the animal, but when the irritation was continued until the ganglia became red and inflamed, that acute pain was then produced by every puncture; that when a ganglion had been thus irritated and rendered sensible, its sensibility was again destroyed by the section of the nerve which connected it with the spinal marrow; but if the irritation were renewed after the lapse of a few minutes, the ganglion was found to have regained its sensibility; of which, however, it was finally and completely deprived by making a section of the nerves of communication passing between it and the ganglia situated immediately above and below it; that when a ganglion had been excited to sensibility, subsequently to the section of its spinal branch, it was permanently deprived of this property, by dividing the nervous twigs passing from the spine to the two ganglia, situated immediately above and below that where the irritation was applied.

[1] Bichat, Anatomie Genérale, translated by Caffyn.

[2] Magendie, Precis Element de Phys.

[3] Recherches, Exp. sur les fonctions du Syst. Nerv. Ganglion.

So far, therefore, as experiments of this nature may be relied upon, the following conclusions may be deduced as applicable to neuralgic affections, viz.—

That the ganglionic system of nerves are insensible to mechanical irritation in their healthy condition, but that they acquire sensibility when in a state of inflammation or excitement, and that they do not possess this function at all, independently of their connection with the cerebro-spinal system.

It is, however, difficult to reconcile these facts with certain phenomena of continual occurrence, where impressions pass with amazing rapidity from one of those systems to the other; as when nausea is excited by the sight of disgusting objects; involuntary dejections in consequence of fear; or when the strength is suddenly prostrated by a blow over the abdomen. Instances are not wanting, either, where the swallowing of acrid ingesta has been immediately followed by pain, not only of the stomach, but of organs deriving their nerves from the brain or spinal marrow.

Beclard explains this apparent anomaly, by supposing that mechanical or chemical irritations do not pass along the ganglionic nerves, but that galvanic irritation is conducted by them and determines sensations and contractions.[1]

Little has hitherto been ascertained respecting the pathology of the sympathetic nerve; it has been but rarely observed with unequivocal marks of disease. In some instances, however, cases of this kind have been met with, where the functions of the organs in connection with the diseased ganglion were disturbed, and sometimes visceral pains were excited; whilst in other cases of this kind this symptom was altogether absent.

Of the pathology of neuralgia.—We possess no certain knowledge of the abstract nature of neuralgia, being acquainted with it only by its effects; it may be defined a preternatural elevation of function in one or more sentient nerves, without corresponding excitement in the vascular, or of the great mass of the nervous system.

It was supposed, by Dr. Fothergill, to be connected with a cancerous diathesis, an opinion which experience has proved to be totally unfounded. The theory of the syphilitic nature of neuralgia is equally untenable. Cases undoubtedly occur from the absorption of venereal virus, but it is more probable, if the history of that affection be considered, that the symptoms proceed from the changes, which it effects in the structure of parts, such as periostitis, nodes, enlargements, ulceration, &c., than that the nerves themselves become affected by the poison.

The identity of one form of neuralgia and rheumatism is maintained by some modern pathologists, who conceive the latter to be neuralgia of the nervous filaments of the joints;[2] but notwith-

[1] Beclard, Anatomie Génerale, translated by Knox.

[2] Jolly. Bulletin de la Societé d'Anatomie.

standing that there is a striking resemblance between these affections in many points, there are others in which they materially differ.

The case of Rushen[1] is an example of neuralgia of the joints. The situation of the pain, and its disposition to change suddenly to other joints, partook of the character of rheumatism; but the total absence of fever—the entire disappearance of the pain for certain intervals—the absence of heat or swelling in the affected part—the slight aggravation of suffering produced by the motion of the limb—seem to prove that the disease was confined to the nervous filaments, leaving the muscles unaffected.

Another proof of the distinct nature of these affections is furnished by the neuralgia supervening in the course of rheumatism, being distinguished from that affection by the usual lancinating character of the pain, by its periodicity, and by its removal through remedies which make no impression on the rheumatism; a curious example of which is given in the following case. A woman, aged 39, was attacked with acute pains in the shoulders, the left arm, and right thigh, increased by pressure and motion; the parts were slightly swollen and pale, the pulse quick, the skin hot, and there was much thirst. In addition to these symptoms, the patient was attacked every half hour with a sensation of numbness and thrilling pain, similar to that excited by striking the ulnar nerve at the elbow. The pain extended along the inner part of the arm, fore-arm, and hand, and was extremely severe. Leeches, blisters, morphia, and a variety of other remedies were employed without effect. Relying upon the intermitting character of this pain, the quinine was administered, by which the neuralgic affection was removed, although no impression was made on the rheumatism.[2]

Some authors have given the name of rheumatic neuralgia to this complication, a name which at least implies some difference in the nature of the neuralgia in these cases. May not the true explanation be, that these two complaints, when they coexist, stand towards each other in the relation of cause and effect, and that the neuralgia may occasionally be the result of the pressure of nervous filaments, in consequence of the swelling which accompanies rheumatism?

In addition to the foregoing facts, it may also be remarked, that neuralgia, in some instances, does not begin until the rheumatism has nearly subsided, and (as happened in Mr. Piorry's case) often occupies a different station, or extends beyond that of the rheumatism. For these reasons, I have ventured to assign rheumatism a place among the exciting causes of neuralgia.

Neuritis.—Neuralgia is believed by some authors to consist of inflammation of the nerves.

Larrey, speaking of tic-douloureux, describes it as "a chronic and inflammatory turgescence of the neurilema, which envelopes

[1] Case xvii.

[2] Piorry Clinique Médicale.

the nerves of the part affected.[1] Neuralgia, according to Descot,[2] is nothing more than a chronic neuritis.

"If the nerves are susceptible of inflammation," observes Montfalcon, "which it would be a medical heresy to deny, it is more than probable, it is indeed certain, that neuralgia is that inflammation." The same author remarks, that "the natural place of neuralgia, in a nosological arrangement, is among the phlegmasiæ."[3]

It is of the greatest importance to examine into the facts upon which these and other authors rely, in support of their views respecting the nature of the disease; and to ascertain whether it can be established as a pathological axiom, that neuralgia and neuritis are one and the same affection.

The circumstances connected with the general history of the disease supposed to favour this view, are: that its exciting causes are often of a description that are well known to induce inflammation of other organs, as exposure to wet and cold, contusions, external irritants, &c.; that the disease is generally seated in the superficial nerves, which are most exposed to the action of these causes; that the pain is often confined to the tract of a nerve or of nervous filaments; that it is increased on pressure; and that, occasionally, there is a tendency in the disease to spread along the course of a nerve, after the manner of some forms of inflammation.

To these arguments, however, it may be replied: that the cutaneous nerves are often the seat of the pains, from spinal or cerebral disorder, or from other causes not acting as direct irritants of the affected nerves—and, in fact, this is one of the most invariable characters of the disease; that although the pain is excited by the contact of a light substance, it is often relieved by firm pressure; and that it sometimes attacks a nerve, and follows its course with anatomical precision, when disorder of the primæ viæ is the cause of the disease.

Neither is it any evidence of neuritis, when the pain is observed to spread upwards in the course of the affected nerve, or when a wider circle of parts in connection with the nerve becomes gradually involved in the morbid action; for the same course is observed where there is sufficient proof that the nerve was not inflamed; a fact which is well illustrated by the following interesting cases of Mr. Wardrop.

In one case, which originated in pricking the forefinger of the right hand with a gooseberry thorn, these symptoms occurred. "The nervous paroxysms usually attacked her two or three times a day, and one of them always came on at the time of her rising out of bed. During these attacks, the pain extended along the finger to the back of the hand, and between the two bones of the fore-arm, darted through the elbow-joint, stretched up the back of

[1] Larrey on the Use of the Moxa.

[2] Descot, op. cit.

[3] Dict. des Sciences Medicales, art. Neuralgia.

the arm to the neck and head, producing a sensation at the root of the hairs, as if they had become erect."[1]

In another case from the same author, in consequence of an injury of the digital nerve, the pain extended up the arm to the neck and side. In the first of these cases, the finger was amputated; in the other, the nerve was divided above the injury; the operation was, in both instances, entirely successful, being instantly succeeded by the total subsidence of the symptoms. No trace of inflammation could be discovered in the nerve of the amputated finger.[2]

May it not be inferred, that, in the foregoing cases, the pains which occurred in the parts above the seat of the injury could have had only a sympathetic character, and were not dependent upon local inflammation?

In some instances, however, morbid anatomy has disclosed neuralgia connected with an inflammatory condition of the nerve. As an instance of this occurrence, the following case from Gendrin is selected.[3]

Andrew Dubourgh, wagoner, aged fifty-eight, entered the hospital with symptoms of pneumonia, which continued about four days; he complained also of acute pain in the right knee, numbness of the feet, and painful shootings along the course of the sciatic and external saphena nerves. These pains had preceded the attack of pneumonia four or five days; they had changed their seat several times, and had even attacked the opposite limb. The application of leeches, and a perpetual blister over the head of the fibula, procured slight relief. In the meanwhile, the pneumonia continued with undiminished severity; there was swelling of the foot and leg, which did not pit under the finger. The patient died on the eighth day after his admission into the hospital.

At the post mortem examination, the right sciatic nerve, from the lower fourth of the thigh, the tibial nerve, to the point where it passes between the gastronemii muscles, and the external saphena nerve, in nearly its whole course, were inflamed.

The inflammation was characterised by a slight redness with serous infiltration, and a moderate degree of tumefaction of the above nerves, particularly of the saphena nerve at its commencement. This nerve was at least double its natural size, of a uniform scarlet colour, and of a hard fleshy texture. In endeavouring to dissect the numerous fibres, both from above and below, towards this spot, they broke, and appeared involved in a spongy cord, which was infiltrated with blood, and resistent to the touch; a section of this cord showed nothing but small coagula of blood. In contact with the inflamed saphena nerve, below the gastronemii, was a collection of pus, rather effused into the cellular membrane, then enclosed within an abscess, and not penetrating the substance of the nerve.

[1] Wardrop, Med. Chirurg. Trans. vol. viii.
[2] Ditto, vol. vii.
[3] Gendrin, Hist. Anat. de l'Inflammation.

The filaments of the sciatic and tibial nerves were separated and, as it were, dissected, by means of infiltrated serum, to a considerable distance both above and below the seat of the inflammation.

Similar cases of acute neuritis, giving rise to neuralgic symptoms, are mentioned by other authors, where the affected nerves were found redder than natural, indurated, thickened, with serum, blood, pus, &c., effused between their fibres.

But there is a manifest difference between attacks of this nature, sudden in their invasion, and rapid in their course, when compared with the usually slow progress of a neuralgic affection; which, if it really possess an inflammatory nature, must belong, in the great majority of cases, to the chronic form, a condition which the most experienced pathologists agree is rarely met with. This fact at once destroys the probability of its identity with an affection so common as neuralgia. In the following cases, however, collected from various authors, the disease appears to have arisen from chronic neuritis, or from some of the consequences of that disorder.

In a case of sciatica, detailed by Cotunnius, the affected nerve, from its origin to its termination, was found of a deeper colour than usual, and the neurilema was unusually thick, and contained a large quantity of serum.[1]

In the same affection, Cirillo found the sciatic nerve hardened to the density of cartilage.[2]

Bichat,[3] in a case of sciatica, discovered the vessels which entered the superior portion of the nerve in a dilated state. Ronsset,[4] in a similar case, found a flaccid condition of the neurilema, and its veins varicose. Andral in one instance found this nerve enlarged.

Siebold[5] discovered an intercostal nerve, in which neuralgia had been seated, redder than usual, and much wasted.

Swan[6] found the median nerve, which had been affected with neuralgic pains, thicker than natural.

In the neighbourhood of ulcers which had been unusually painful, nerves have been found inflamed and thickened; and when neuralgic affections occur in the stump of an amputated limb, the nerves often present the same appearances.

These cases are valuable, inasmuch as they establish the fact of the occasional dependence of neuralgia upon chronic inflammation of nerves; but if they are employed to deduce any inference as to the nature of the disease, the most erroneous opinions must be arrived at. They are, in fact, rare exceptions to the common course of the complaint, which in general leaves no trace of its existence in the nerves which have been affected with it.

Desault examined two patients who had been affected with facial

[1] Cotunnius, De Ischiade Nervosa, 1770.
[2] Cirillo, Prakt. Bemurkung.
[3] Bichat, op. cit.
[4] Dict. des Scien. Med. art. Neuralgie.
[5] Table Synop.
[6] Op. cit.

neuralgia on one side only; but the nerves of both sides were found precisely similar.[1]

Several cases of neuralgia were examined by Martinet, where the nerves presented no morbid appearance.[2]

Andral made a careful dissection of the affected nerves in many cases of sciatica, but, except in one instance, already mentioned, the affected nerves presented their natural appearance. He also inspected the bodies of several patients who died of an epidemic that prevailed at Paris in 1828, the most remarkable symptom of which was excessive sensibility of the hands and feet. No trace of disease could be found in the affected nerves. The same pathologist dissected the body of a woman, who, during the latter months of her life, had suffered severely from pains of the occiput and side of the neck, which, Andral observes, had all the characters of neuralgia. The nerves of the axillary and cervical plexus were followed with the greatest caution throughout all their ramifications, and were found to retain their healthy appearance in every respect.[3]

Piorry examined the body of a patient who had been affected with acute pains in the left shoulder, which also extended over the left side of the thorax and down the arm to the fingers; the nerves of the brachial plexus and those of the neck were dissected with the greatest care, but no lesion could be discovered in them.[4]

These cases, which are selected from many others, are considered sufficient, from the total absence of morbid alterations in the structure of nerves which had been the seat of neuralgia, to afford presumptive evidence at least, that those parts were not affected with inflammation.

There are, moreover, some other phenomena connected with neuralgic affections, which it is difficult to reconcile with an inflammatory origin;—as their sudden commencement upon the application of an obvious exciting cause—a disordered stomach for example; their abrupt termination when that cause is removed; the total absence of febrile excitement, and often of redness or heat in the affected part; and the decided influence on them of remedies which cannot be supposed to relieve inflammation.

The general effect of inflammation on the nerves is to induce change of structure, by which they are subjected to a certain degree of pressure, which would prove a source of irritation amply sufficient to account for the symptoms of neuralgia, even in the absence of inflammatory action. In some cases the neuralgia is felt in a different portion of the nerve from that where the inflammation is seated; and sometimes it attacks another, and even a remote nerve, as in the case quoted from Gendrin. Moreover, the pains of

[1] Bichat, op. cit.
[2] Revue Médicale, 1834.
[3] Andral, Précis. d'Anat. Pathol., vol. ii.
[4] Piorry, op. cit.

neuralgia and those usually observed in neuritis are distinct, the latter being dull and constant, the former lancinating and paroxysmal. These considerations have induced me to class neuritis and its sequelæ among the exciting causes of neuralgia, instead of assigning to this affection an inflammatory nature.

It has been supposed, that whatever may be the origin of the disease, the affected nerves are in a state of hyperæmia during a neuralgic paroxysm. This opinion has arisen in consequence of the skin over the affected nerve being sometimes observed to change into a deep red colour during the attacks. But when this process is carefully watched, it will be found that the colour becomes deeper as the pains grow more intense, and that when this local action of the vessels is greatest, the paroxysms begin to subside, and the skin gradually to assume its natural appearance. It is plain, therefore, that this symptom ought not to be regarded as the cause of the paroxysm, but, on the contrary, as the consequence of the irritation occasioned by the pain—in accordance with the medical axiom, ubi stimulus, ibi fluxus.

It may be here again enquired:—Is neuralgia a disease or merely the symptom of a disease? It certainly is as much so as many cases of epilepsy, chorea, hysteria, &c., denoting equally with them, that a portion of the nervous system is in a state of morbid excitement. It cannot be considered of the same nature, or merely an aggravation of the pain commonly attending disease, but as something superadded to it, and that does not necessarily arise, even in the most aggravated affections. Indeed it is rarely observed in, if it be not altogether incompatible with the existence of, acute inflammation; and it is remarkable that the most distressing cases are often dependent upon causes apparently insignificant; whilst in many instances no morbid appearance can be discovered to account for the symptoms. When neuralgia arises from a cause which is from its nature permanent, it often disappears for considerable intervals, and requires a very different mode of treatment from that which is desirable in the disease with which it is connected; and when it originates in some accidental and transient circumstance, the pains are often continued long after every vestige of the primary affection has disappeared. Whether it can ever be excited without the intervention of a local cause, is a question to which it is impossible to give a satisfactory answer: and when it is remembered that the most excruciating neuralgia may be produced by a substance not larger than the head of a pin; by the dilatation of a vessel pressing upon its accompanying nerve, or of those which enter the nervous substance, or other slight derangements, probably disappearing soon after death, what anatomist will venture to assert that no such lesion had existed?

Pinel observes, "Differentes observations semblent devoir faire conclure que dans la nèvralgie il exist une cause materielle d'irritation fixée sur le nerf, que cette cause n'est pas la même dans tous

les cas, et qu'ainsi il faut la connaitre pour etablir un traitement efficace."[1]

These cases, where the disease remains unchanged after its original exciting cause had apparently ceased to act, may be imagined to furnish examples of neuralgia occurring independently of local causes; but here, also, it may be presumed that the local morbid action of the nerves has been communicated to the blood vessels, and that some irregularity in the cutaneous circulation has been induced, so as to keep up the disease. The presence of œdema over the affected part, shows that the capillary circulation is disturbed in some instances, and the lancinating pains which precede the eruption of herpes zoster, seem capable of explanation on the same principle.[2]

When the disease arises from causes acting as depressants or excitants of the whole system, such as malaria, anæmia, &c., and totally disappears under the use of general and tonic or stimulating remedies, as bark and steel, it may seem to possess a constitutional origin; but nothing is more likely to occur, under the action of these causes, than local congestion, a condition sufficient to account for the symptoms, and which the class of remedies alluded to would probably remove.

It has been supposed, also, that the tendency so often observed in neuralgia to wander from one organ to another—no sooner being subdued in one part, than appearing in another—indicates the presence of some cause, equally active in all parts of the body; and that these cases at least should be regarded as having a constitutional and not a local origin; but a little consideration will show the fallacy of this reasoning; for there is the same disposition of the disease to change its seat, where the cause is well ascertained to be strictly local, such as a decayed tooth, an aneurism, &c., and as has already been observed, the pains often fix upon an organ placed under any inordinate conditions of excitement or depression.

The manner in which the irritation is conveyed in such cases, from one organ to others more or less remote, is not always discernable; in some instances, it is traceable by successive steps along the spinal marrow, occasioning tenderness over different portions of that substance, and converting it into a focus, from which the pain radiates along the nerves; in others, the brain forms the centre of communication, whilst in some cases, the pain simply passes to other ramifications of the nerve originally affected.

If an analysis be made of the exciting causes, with the view of ascertaining the species of irritation upon which neuralgia depends, the results thus obtained are not uniform, although in the greater number of instances they appear capable of being reduced to mechanical irritation, directly applied to some portion of the nervous

[1] Pinel, Nosograph. Philosoph. vol. iii.
[2] See Travers on Constitutional Irritation.

system, as tumours, enlarged organs, bony spicula, aneurisms, thickening of nerves, effusions beneath their neurilema, &c.

There are others, in which the presence of such irritation may be rationally suspected, although it cannot be so easily demonstrated; as in morbid action of the heart; in anæmia; and in other conditions which have a tendency to induce topical congestions of the various organs, and thus, directly or indirectly, to become a source of mechanical irritation.

Diagnosis.—The symptoms of neuralgia are, in general, sufficiently characteristic of the disease. It may sometimes, however, be mistaken for other painful affections, as rheumatism, neuritis, &c., and, when seated internally, for visceral inflammation.

From rheumatism it may be distinguished by the nature of the pain, which in that affection is gnawing or pungent; whilst in neuralgia it is lancinating or thrilling; by the duration of the pain, which in rheumatism is either continued or remittent, but in neuralgia is intermittent or periodical; by the effects of pressure, which in rheumatic affections greatly aggravates the sufferings, but often relieves them in neuralgia.[1]

It may be distinguished from acute neuritis, by the absence of fever; by the duration of the complaint; by the pains of the neuritis being greatly aggravated by pressure in the course of the nerve; and by the nerve itself, when situated superficially, being found thickened and prominent.

It is not so easy to distinguish neuralgia from chronic neuritis; but the extreme rarity of the latter affection renders the diagnosis a matter comparatively of little consequence.[2]

The most important part of this subject is, to consider the signs which distinguish internal pains of a neuralgic nature, from those which proceed from inflammation. It is needless to remark, that a mistake on this point might endanger the life of the patient, and would be ruinous to the reputation of the practitioner.

Happily, in the greater number of cases, a little attention will suffice to distinguish these affections; the absence of febrile excitement; the severity and intermitting character of the pain; the effects of firm pressure; and especially the tendency to change from one internal organ to another; or to alternate with nervous pains of an external organ; are generally sufficient to evince the true nature of the disease.

But there are cases, in which the diagnosis is far more difficult; where the pain is fixed, and increased by pressure; and the pulse is as much excited as in visceral inflammation. But even in these cases the experienced practitioner is struck with something remarkable in the symptoms; thus, the tongue may remain clean and moist, and the appetite good; or the pain may be diffused over a larger surface than is generally affected in inflammation. There may be symptoms of general nervous irritation; and often, when

[1] See page 219. [2] See page 220.

the patient's mind is diverted from his complaint, pressure over the affected organ may be made with impunity.

Another method of distinguishing these affections has latterly been advanced; namely, that when internal pains have a neuralgic origin, in nearly every case there will be found tenderness over that part of the vertebral column which has a connection, by means of nerves, with the affected viscus; but that when the symptoms depend upon inflammation, this tenderness is in no case observed.

After a careful examination of a large number of cases, I feel justified in remarking, that this diagnostic sign cannot be trusted with safety. It is entirely absent in many cases of visceral neuralgia; nor does the second branch of the diagnosis hold good in all instances; for in some cases of chronic visceral inflammation, unattended with disease of the spine, tenderness over the vertebral column is present; as in the following case.

A plethoric woman, aged thirty-eight, complained of acute pain in the right hypochondrium, aggravated by pressure; the pulse was quick and small, and the cheeks covered with a hectic flush; there was extreme tenderness over the seventh and eighth dorsal vertebræ, and pressure over this spot occasioned an aggravation of the pain of the right side; soon afterwards, she experienced a sensation of something bursting internally, and at the same moment, the pain of the side ceased, and a large quantity of purulent matter was afterwards passed by stool.

It must be admitted, however, that this diagnosis is very often so difficult, as to make it desirable to assist it by a cautious trial of the remedies for inflammation, closely watching their effects, and the subsequent progress of the disease.

Prognosis.—As a general rule, the prognosis in neuralgia is favourable as to its fatal tendency, and unfavourable as to its duration. The nature of the predisposing and exciting causes must chiefly be considered, in giving an opinion on this subject; when these are of an evanescent nature, the neuralgia also may be expected to pass away quickly; but when the disease proceeds from a cause either permanent or liable to perpetual renewal, the prognosis should be given accordingly. It is necessary to remember, however, that neuralgia is very likely to return, when it has once attacked a patient; and, therefore, on this point it is best to give a guarded opinion. The disease usually disappears, or at least becomes greatly mitigated, in the later periods of life.

Treatment.—It would be difficult to mention a pharmaceutical substance endowed with any energy, that has not, at some period, been supposed to possess a specific power in the cure of neuralgia. This reputation has been successively appropriated to medicines of the most opposite qualities, without regard either to the origin of the symptoms or the condition of the patient. It is no wonder, in a practice so empirical, that disappointments frequently occurred; until at length unbounded confidence in the efficacy of a remedy became changed into the opposite extreme of unmerited neglect.

Another source of error, in estimating the value of a remedy in neuralgia, exists in the natural tendency of the disease to intermit, and sometimes to disappear for long intervals; this spontaneous cure may be mistaken for the effects of treatment; and the same circumstance also largely contributes to the remarkable discrepancy of opinion formed by different practitioners, regarding the effects of a particular medicine.

But it is by a careful and patient investigation of the causes and habitudes of this dreadful malady, rather than by the introduction of a new remedy, that any improvement in the manner of treating it is to be hoped for. In too many instances, no grounds for a rational treatment can be discovered; the following attempt to arrive at that object, I feel and acknowledge to be very imperfect.

With reference to its exciting causes, neuralgia may be divided into—

I.—Cases where the symptoms continue after the original cause has ceased to exist.

II.—Cases arising from functional disorders.

III.—Cases occasioned by causes of an irremediable nature.

IV.—Cases where the cause cannot be ascertained.

I.—Under the first class, are included those cases of neuralgia which can be traced to causes that have already disappeared; as when the pains continue after the subsidence of a cutaneous eruption, the removal of a tumour, the extraction of a tooth, &c. These cases generally yield rapidly to remedies which act powerfully on the nervous system; to be presently enumerated.

II.—In the cases comprehended under this section, the first indication is to remove the cause upon which the disease obviously depends; until this preliminary treatment has been accomplished, the remedies which, in the first class of cases, often afford relief, will generally be of no avail, and may increase the severity of the symptoms. But when the original disorder has been removed, the pains frequently disappear without further treatment; or, at least, may now be removed by those remedies which had previously failed to make any impression on them.

III.—In this class are placed those unfortunate cases depending upon causes of an irremediable character; but even in these the nervous pains may be aggravated or calmed, according to the state of the disease with which they are connected.

The same remark is applicable to neuralgia accompanying malignant diseases; the sufferings, even in these wretched cases, may be lightened, and sometimes rendered comparatively mild, by first subduing any inordinate cause of excitement of the diseased organ, and subsequently administering the more specific remedies for neuralgia.

IV.—This section embraces those numerous cases where the cause of the nervous pains cannot be discovered, and where the practice must therefore be in a great measure empirical.

In a work like the present, it will not be necessary to dwell upon

the preliminary treatment; a few remarks on this subject may, however, be useful.

As neuralgia is, for the most part, a chronic disease, it is seldom necessary to adopt the antiphlogistic treatment; but where the patient is plethoric, or where there is febrile excitement, it may sometimes be employed with advantage. In a case of sciatica occurring in a plethoric man, for which I had tried various remedies during several weeks, the symptoms were materially alleviated by a single bleeding; but, in general, this practice gives no relief, and indeed the symptoms are often aggravated by its employment.

It may sometimes be necessary to prescribe blood-letting for persons of a full habit affected with neuralgia, as a precautionary measure, before the administration of tonic or narcotic remedies can be ventured upon with safety.

Great benefit is frequently derived from local bleeding, by cupping or leeching. The latter, particularly, is of essential service in many cases, where the pain is attended by heat or swelling, or where the affected part is more than usually irritable.

When the disease attacks patients in a debilitated state, an opposite plan of treatment should be adopted, and remedies administered for the purpose of strengthening the system, and invigorating the circulation. Care should be taken, however, to avoid overloading the stomach with tonic remedies, which often produce an effect opposite to that which was intended.

This class of remedies ought not to be prescribed indiscriminately, nor without examining into the cause of the complaint: where there is considerable cerebral disturbance, they are obviously contra-indicated, and their exhibition might be followed by apoplexy, to which there is an evident tendency in some cases, especially of facial neuralgia.

In neuralgia dependent upon cutaneous eruptions, relief may often be effected by touching the vesicle or pustule with lunar caustic. In herpes zoster, for instance, I have succeeded in removing the severe neuralgic pains almost instantly by this means. Sometimes, in these cases, one or two vesicles are pointed out as the chief source of the suffering; but, in general, it is better to apply the caustic to the whole of each group, or to cover them with a strong solution of this substance.

When the disease proceeds from the irritation of an old cicatrix, it may sometimes be removed by the same treatment. M. Verpinet mentions a case of a lady, who received a wound of the arm from the point of a sword; violent neuralgic pains subsequently attacked the arm and wrist, shooting to the extremities of the fingers. After trying various means, the cicatrix was touched with the actual cautery; a slough came away, and the pains ceased entirely.[1]

I have found this plan of treatment useful in several cases, although the pains are very apt to return when the effects of the

[1] Journ. de Méd. vol. x.

caustic begin to disappear. It is best, not only to touch the cicatrix itself, but also to insulate it from the surrounding skin, by a circle of caustic. A very remarkable circumstance may sometimes be observed when the insulation is incomplete;—the pains being checked in their usual progress, shoot through the opening thus left for them, and attack the neighbouring parts.

Sometimes a permanent cure may be obtained by removing the cicatrix by a surgical operation. I am indebted for the following case, where this operation was successfully performed, to the kindness of Mr. H. Taynton.

Miss P. in January last, by a slip of the knife in carving, cut the extremity of the fore-finger; the wound healed rapidly, leaving a cicatrix more than usually indented. Soon after, severe pains commenced about the spot; which subsequently extended along the palmar aspect of the arm, to the bend of the elbow, and were aggravated in paroxysms. Pain was also felt on pressure in the situation of the cicatrix. After a trial of various remedies without the least benefit, Mr. Taynton, in the month of April, removed the cicatrix with the knife. From that time the patient has been entirely free from all pain. The wound from the operation healed quickly.

It has already been stated that an injury received a long time previous to the appearance of the neuralgia, is sometimes its unsuspected cause; and, in obscure cases, a strict enquiry upon this point may lead to the discovery of such a cause, and to a successful mode of treatment. Thus, a spot exquisitely tender under pressure may be found, which is sometimes (especially when seated in the scalp) swollen and puffy. At other times, however, this same spot may be pressed and examined without the excitement of pain. In Hawker[1] this circumstance was very remarkable; for sometimes the injured portion of the scalp had no unnatural tenderness, whilst at others the examination induced exquisite suffering; and upon one occasion a paroxysm of epilepsy ensued. The application of caustic or blisters over the seat of the injury is sometimes useful; but when those and other common means of relief have failed, a crucial incision over the part may be tried with advantage. A case of this kind has already been mentioned, where Pouteau adopted this practice with complete success.

When the disease is occasioned by a small sub-cutaneous tumour, the only remedy is to remove it, which in most cases can be done without difficulty. The operation consists in making an incision around the tumour, and afterwards separating it from its connections.

When the tumour is connected with the trunk of a large nerve, the operation of removing it is much more hazardous.

Supposing (observes Mayo) "the remedies by which swellings

[1] See Case ix.

are dispersed to have been properly but ineffectually tried, there remain the following measures:

"The exposure of the tumour, which if separable from the surface of the nerve, or from the body of the nerve, at the expense of a few fibres, should be removed, whether solid or a cyst; if completely implicated with the whole structure of the nerve, and that nerve a small one, it should be removed with the portion of the nerve involving it; if so implicated, and the nerve the sciatic, and the tumour a cyst, the cyst might be punctured, and the fluid evacuated, every precaution being subsequently taken to unite the wound by adhesion, leaving the chance of the fluid not re-accumulating. In the last case, supposing the tumour to prove solid, another question might still arise—whether the nerve being first divided above the tumour, the latter would not admit of being dissected out of the so palsied nerve with more probability of safety to the patient, than if the nerve to be operated on were left in communication with the brain; of course, if, in such an operation, the tumour should be found to implicate the nervous structure, or to leave no separable and wholesome fasciculi, the operation must be abandoned."[1]

In neuralgia from spinal irritation, the indications are the same as those before mentioned in the general consideration of the disease. The original cause of the pains should be sought for, to the cure of which the principal treatment should be directed; but when the sufferings of the patient demand the adoption of some palliative mode of treatment, relief may sometimes be obtained by the application of blisters or leeches to the spine, even when the original affection is unaltered. By this means the nervous pains may be suspended for a short interval, which should be employed in restoring the functions of the organ, in the disorder of which the whole train of symptoms originated. When this precaution is neglected, there is reason to apprehend that the pains will, in the great majority of cases, sooner or later re-appear. In some instances, however, a single application of a blister or leeches to the tender portion of the spine, entirely removes the complaint.

Mr. Tate observed great benefit in several cases from the employment of friction with tartar emetic ointment over the spine, even in cases where common blisters had failed to relieve.[2]

When neuralgia is suspected to have a syphilitic origin, and will not yield to the common mode of treatment, the exhibition of mercury, so as to induce a moderate degree of salivation, may sometimes be tried with advantage.

Waton relieved two patients who had for some years suffered from facial neuralgia, arising from syphilis, by rubbing in mercurial ointment, so as to induce salivation.[3]

[1] Mayo's Outlines of Human Pathology.
[2] Tate on Hysteria.
[3] Journ. de Médicine, 1793.

The preparations of iodine may be found valuable in cases of this kind; I have also seen much benefit from the extract of sarsaparilla, taken to the extent of half an ounce daily, for several weeks. Sometimes, relief may be obtained in painful syphilis by the employment of nitric acid lotions and opiates.

Some practitioners rely chiefly upon mercury as a remedy in neuralgia even when no connection with syphilis is apparent. It was employed by the elder Frank, in the form of calomel, combined with antimony and musk. Several cases are published in the Medical Journals where its exhibition, either alone or combined with opium, was completely successful. In my own practice, I have been induced, in a few cases of inveterate neuralgia, to prescribe mercury, so as to induce salivation, but I cannot recollect a single instance where the symptoms were subdued by this treatment.

Mr. Scott has lately published several interesting cases, where the disease, in various parts of the body, was arrested by the application of the proto-ioduret, or deuto-ioduret of mercury, in the form of an ointment over the affected part. This mode of treatment generally occasions considerable irritation of the skin; when this effect is produced, its use should be suspended, and renewed after a short interval. By adopting this practice, Mr. Scott relieved several cases of neuralgia, where various remedies had previously been unavailing.[1]

When neuralgia assumes an intermittent, or even a well-marked remittent character, it is often subdued by the remedies found most useful in the cure of ague. Soon after the introduction of the bark into the materia medica, it was employed as a remedy for intermittent headaches, and is praised for its efficacy in those cases, by Morton and Van Swieten[2]. In modern times the quinine is generally substituted for the bark, and its utility in periodical neuralgia may be considered as fully established. This medicine is exhibited by the continental physicians in much larger doses than it is usual to prescribe it in this country. In many cases this practice seems to have been successful in arresting the return of the paroxysm, when smaller doses had failed. It has been frequently given to the amount of gr. x. four or five times a day.

Arsenic.—The form in which this medicine is usually exhibited is that of the liquor arsenicalis. It has been used much more extensively in neuralgic affections, since Dr. Fowler pointed out its efficacy in periodical headache.

Numerous cases are recorded, where a cure was effected by this medicine; and most practitioners of experience regard it as an important remedy in neuralgic affections. It is more particularly indicated, where the pains assume an intermittent or periodical type; but it has often been found useful in cases where the

[1] Cases of tic-douloureux and other forms of neuralgia.

[2] Van Swieten, op. cit.

paroxysms observed no regular form. I have tried it in several instances, and can add my testimony to its value.

The dose of this medicine, at the commencement, should not exceed five minims three times a day, which may gradually be increased to fifteen minims, observing the usual precautions, in suspending its exhibition when the poisonous effects begin to appear.

Nux vomica.—This medicine was praised by Linnæus, as a remedy for gastralgia, but until lately it has not been generally employed in neuralgic affections; I have been induced to place it among that class of remedies recommended in periodical attacks, because having employed it in a large number of cases, I am satisfied that it is more beneficial in intermittent and remittent neuralgia, than in other forms of the disease. I have treated three cases of ague successfully with this remedy.

Under proper precautions, it is, I think, one of the best remedies we possess for the cure of neuralgia; it seems to agree better with persons of the leucophlegmatic, than with those who have a strong nervous temperament; but it seldom fails to aggravate the symptoms, and to create much general irritation when given to hysterical females. The preparation which I have generally used, is the alcoholic extract, in doses of a quarter of a grain to one grain, three or four times a day. I have preferred this form, because it appeared to me rather less irritating than the strychnine, which, however, may be sometimes advantageously substituted for it.

Purgatives.—Whatever may be the cause of a neuralgic affection, it is highly important to exhibit purgatives, either alone or in conjunction with other remedies. In many cases, the symptoms disappear when a free evacuation of the bowels is procured. Rahn collected several cases, to prove the connection of nervous pains in various parts of the body with disorder of the bowels, and the importance of purgative medicine in their cure.[1] Latterly, Sir Charles Bell has strongly insisted upon the efficacy of this treatment, and has detailed five cases of facial neuralgia, where it was attended with complete success.[2] But, on the other hand, it is often, unfortunately, of no avail; and there are few protracted cases, where the patient has not been repeatedly subjected to this treatment by different practitioners.

Opiates.—Most practitioners condemn the employment of opium, or its preparations, in the cure of neuralgia, on account of the tendency of that drug to constipate the bowels, and to induce nervous irritability. Some, on the contrary, have highly commended it; the acetate of morphine was employed by Dr. Bardsley, of Manchester, who succeeded in effecting a permanent cure of several cases by its use.

I have frequently tried it, and occasionally with success, although

[1] Rahn, Mirum inter Caput et Viscera Commercium, 1771.
[2] Sir C. Bell, Clinical Lecture of tic-douloureux, Med. Gaz. 1836.

in general, the relief obtained was only temporary. It is no trifling advantage, however, in this disease, to obtain even momentary relief for the patient; and when opiates are known not to disagree with him, it would be cruel to withhold them in the height of the paroxysms.[1]

Datura Stramonium.—This medicine is now frequently prescribed for the cure of neuralgia, and several cases are recorded by respectable practitioners, where it produced beneficial results. Lentin exhibited the tincture in several cases of fascial neuralgia, in doses of four or five drops, every third hour; and found it more useful than any other remedy of which he had any experience.[2]

Dr. Marcet cured two cases of severe chronic sciatica and several of fascial neuralgia, by employing Hudson's extract of stramonium;[3]

Dr. Begbie, also, has cured several cases of sciatica by the same means.[4]

The extract of stramonium of the London Pharmacopœia, was given at the City Dispensary in ten cases of neuralgia, with the view of ascertaining its value as a general remedy in these affections; in two cases, slight relief was obtained at first, but it was merely temporary; in a third (sciatica), the pains were completely removed, after having teased the patient about twelve months; in all the other cases, no alleviation of the symptoms was obtained.

Belladonna.—This substance has often been employed in the treatment of neuralgia. It may be given in doses of a quarter of a grain of the extract every two or three hours, until vertigo or other symptoms of its full action appear. The cases recorded, in which this medicine proved beneficial, are very numerous.[5] I have found it useful in a few instances.

In a case of severe enteralgia, the pains were removed after the second dose of this medicine, when other narcotics had been tried in vain; but it often aggravates the symptoms, causing a wretched sensation of stupor in addition to the pain, especially when it is prescribed without previously attending to the state of the bowels, or without first removing, or at least moderating, the irritation in which the neuralgia originated.

Conium. — This remedy was successfully employed by Dr. Fothergill in his cases of fascial neuralgia, and, for some time subsequently, was generally regarded as the chief means of relieving that affection; it has latterly grown into disuse, being superseded by more modern remedies; I am still disposed to regard it as a valuable medicine in neuralgia, having frequently prescribed it with much advantage.

Hyoscyamus has also been much recommended in this disease. It forms one of the ingredients of the pills of Méglin, which have

[1] Bardsley's Hospital Reports.
[2] Blumenbach's Med. Bibl. vol. ii.
[3] Medico Chirurg. Transactions, Lond. vol. vii.
[4] Medico Chirurg. Transactions, Edin.
[5] See Bailey. Obs. on the use of Belladonna.

obtained much celebrity among continental practitioners in cases of the kind. The following is the formula for their composition:—

R Extract: Hyoscyami.
Oxid Zinci.
Extract: Valerian: Sylvestris:—partes equales.

Méglin's patients generally began by taking a pill, containing three grains of this composition, night and morning, gradually increasing the dose, until vertigo, palpitation, or other symptoms of poisoning appeared, which generally happened after raising the dose to eight or ten pills morning and evening; but in one case twenty-four pills were exhibited at the same periods.

It may be doubted, however, whether the hyoscyamus is the chief ingredient of this composition; but it may be remarked that Méglin found the pills almost equally efficacious without the valerian.[1]

Hydrocyanic acid.—This medicine has been praised by some practitioners as useful in neuralgic affections, but I have never observed a single case of external neuralgia, where its administration was attended with benefit. Its usefulness in gastralgia is well known.

Sesquioxide of iron.—Since the publication of Mr. Hutchinson's work, the efficacy of this preparation in neuralgic affections, has been almost universally acknowledged. I have often witnessed the most happy results from its exhibition, even after various powerful medicines had been tried in vain. It is more particularly indicated where the patients complain of debility, and where the surface is pale and the pulse small; it should not be given, unless with great precaution, to plethoric patients; the dose which Mr. Hutchinson recommends, is from half a drachm to two drachms twice a-day;[2] but where it fails to remove the complaint in those doses, Dr. Elliotson advises that it should be increased gradually to one or two ounces. He has detailed several cases, where this practice was followed with complete success.[3]

Local applications.— *Veratria.*—This substance has latterly been much employed in neuralgia, chiefly in the form of ointment composed of half a drachm of the veratria to an ounce of lard. Speaking of this remedy from my own observation, I must observe, that although it is sometimes useful in slight cases, I have never succeeded in obtaining permanent relief from its employment, in any case of long standing.

The pain is often relieved in a most surprising manner by the first rubbing; and sometimes a considerable interval of ease ensues before the return of a paroxysm; but this interval grows less and less after each successive rubbing, until at length it is scarcely protracted beyond the continuance of the disagreeable pricking sensation which this application occasions; and the patient cannot be

[1] Méglin, Recher: et Observ: sur la névralgie Fasciale.
[2] Hutchinson, Cases of Neuralgia Spasmodica.
[3] Med. Chirurg. Transactions, vol. xiii.

persuaded to continue the use of a remedy which at first he had regarded with almost superstitious hopes.

The strychine, also, is useful in some cases, when employed externally as a palliative, in an ointment composed of one or two grains of the alkaloid to an ounce of lard; or dissolved in the same proportions in camphorated liniment. But, although this application may sometimes give relief in a neuralgic paroxysm, like the former preparation, its efficacy is impaired by use; and except in cases where the original cause of the disease had been removed, I have never found it completely subdue the pain; it has one advantage over the veratria, in not exciting the painful pricking sensations which that remedy produces.

Aconite and delphine ointments have been used in the cure of neuralgia, but I have not had an opportunity of witnessing their effects.[1] Other external remedies may often be resorted to with advantage, such as the emplast: belladon: emplast: opii, or bathing the affected part with lotions containing hydrocyanic acid, belladonna, opium, &c.

Counter-irritants.—Much benefit is sometimes derived by the application of rubefacients or blisters over the affected part, and many patients fly to these remedies habitually, when threatened with an attack. The application of croton oil, tartarised antimony, or the linimentum ammoniæ is sometimes beneficial. When blisters are employed, I have found it better to prescribe small ones and change them repeatedly, that to keep them open with irritating ointments.

Some practitioners speak of the moxa as a most valuable application in the cure of neuralgia; Pouteau, Larry, Barras, and many others, cured cases by this method. In my own practice, I have not been able to satisfy myself that it is of greater benefit than other external irritants.

The establishment of an issue, either over the affected organ, or at a distance from it, is sometimes useful; I think this remedy well worthy of trial in obstinate cases, which have resisted the ordinary modes of treatment. If there is any disposition in the pain to wander from its original seat, advantage may be taken of this tendency, by opening the issue over the part which the disease seems inclined to occupy, whenever this is practicable. By this treatment, the pain may sometimes be drawn from its former situation, to that occupied by the issue; where it is generally less severe, and more under the control of other remedies.

In a neuralgic affection of the face (observed by Siebold) which had been suspended during the continuance of a abscess in the shoulder, the symptoms ceased altogether upon the establishment of an issue over the seat of the abscess. Gunther, observing that the symptoms of facial neuralgia were relieved by the suppuration

[1] See Turnbull on Diseases of the Nerves and Eyes.

of a wound in the head, completely relieved the patient by subsequently opening an issue over the same spot.[1]

In Legge,[2] this plan of treatment has been very efficacious. After she had suffered for nearly twenty years from the severest form of facial neuralgia, the pain manifested a tendency to attack the arm, near the insertion of the deltoid; a blister applied over this spot, caused the pain to fly from the face and attack the blistered surface with great violence; and it continued to recur there, so long as the irritation was kept up; this circumstance suggested the propriety of opening an issue in the arm.

It is nearly two years since this operation was performed, and its results have been very satisfactory; the issue is frequently the seat of the neuralgic pains, but they are seldom of a severe character; and although the pain has several times returned to its old situation in the face, it has always been readily removed, either by exhibiting a few doses of purgative medicine, or when that has failed, by the application of stimulating ointment to the issue.

Acupuncturation.—I have never succeeded in curing neuralgia in this manner; the introduction of the needles seems generally to afford temporary relief, but in some instances it increases the suffering. In a case of sciatica where this treatment was attempted, the needles excited inflammation and all the punctures suppurated.

Endermic treatment.—This method of treating neuralgic affections is, I think, well worthy of trial in obstinate cases. The process consists in first applying a strong solution of ammonia, or a common blister, over the affected part, and after the cuticle has been removed, sprinkling the medicaments over the denuded surface. At each application of the remedy, care should be taken to remove the coagulable lymph which has been secreted, so as to allow the absorption of the drug. The only substances that I have employed in this manner, are strychnia and morphia, in doses of from a quarter to two thirds of a grain. In a few cases, the pains were subdued by this method in a remarkable manner, where the common remedies had been of no avail. My friend Dr. Watson has tried this plan of treatment extensively, in the Bath General Hospital, and has practised it successfully in several cases of neuralgia.[3]

A modification of this treatment has been lately recommended by some French physicians, which, in many respects, is preferable to the preceding one, as it can be employed without the necessity of previously removing the cuticle from the part where the medicine is to be applied.

This method consists in inoculating the seat of the pain with the medicament, which is inserted under the skin, in the same manner as in vaccination. Almost immediately afterwards, an areola begins to form around the puncture, and a white tubercle arises over the spot, resembling the sting of a nettle. The tubercle,

[1] Table Synop. [2] See Case XVIII. [3] See Cases VIII. and XIX.

as well as the areola, are much better defined when the morphia is employed, than those which follow the introduction of the strychnia. Considerable itching and tingling accompany this local action, which generally continue about two or three hours, and then subside; about the same time, the skin resumes its natural appearance, with the exception of the slight wound left by the lancet.

I have inserted the morphine and the strychine beneath the cuticle, in at least twenty cases. The first patient[1] whom I treated by this method had been affected with neuralgia of the superior extremities for several weeks. In this man, the effects of the morphia were very remarkable, and the benefit immediate and permanent; but in every subsequent case this practice has completely failed in my hands.

Section of the nerve.—When every means of relief have been exhausted, the unfortunate patient, maddened by the incessant torture, urges the practitioner to attempt some operation which might eradicate his disorder; and, with this intention, a section of the affected nerve has often been made, but with very variable results. This attempt appears to have been first made by Maréchal, a celebrated French surgeon of the last century, who divided the infra-orbital nerve at the point where it emerges from the foramen. The first effects of this operation were highly encouraging, for the patient experienced complete relief, which, however, only continued for two or three days, when the disease again returned with all its former violence.

Some years afterwards, a similar operation was performed by Dr. Haighton, who, at that time, was not acquainted with any previous one. Upon this occasion, the patient was a female seventy-two years of age,[2] who had suffered for many years with the most excruciating facial neuralgia, chiefly affecting the ala nasi and the upper lip on the left side. The infra-orbitar nerve was divided; and in this case the operation was followed by relief. The success of this process excited hopes that a method of curing this formidable complaint had at length been discovered; but these hopes proved fallacious; for the operation generally failed, even in the hands of the ablest surgeons. It was next proposed to remove a portion of the nerve, so as to prevent the reunion of the divided extremities. This plan was successfully followed by Mr. Abernethy in a neuralgic affection of the radial nerve; but in most cases, even when the operation succeeded in arresting the pain for a period, which did not always happen, it was found that only a little longer respite was obtained than when the nerve was simply divided.

Upon the failure of Maréchal's operation, in the patient before alluded to, André pitying her sufferings, suggested the following

[1] Case xx.

[2] The patient was Dr. Haighton's mother. The operation was not finally successful, for the pains subsequently returned. See a letter from Dr. Currie, in S. Fothergill's Treatise on Dolor Faciei Nervorum Crucians.

proceeding, which he practised with success, in that and some other cases.

A plaster, into which several pieces of caustic potash were inserted, was applied over the supermaxillary nerve, where it emerges from the cranium. This application was continued or renewed until the nerve itself was laid bare, the suppuration being encouraged until the bone was exposed. A bistoury was then introduced into the wound, and made to cut across the bone, so as to ensure the division of the affected nerves.[1]

But this formidable process was soon found to be of very uncertain efficacy; for, as in the preceding operations, the pains generally re-appeared with the healing of the wound. This circumstance, together with the distortion which it occasions, must ever be a barrier to its frequent employment, especially in facial neuralgia.

Latterly, a modification of this method, combining the advantages of all the foregoing operations, has been practised. A section of the nerve having been made in the usual manner, and a portion of its substance cut away, each of the cut extremities is cauterised either with nitrate of silver, or by means of a small iron wire heated to whiteness, which is introduced into the wound so as to destroy the nerve, and also forced up its bony foramen. In some instances this plan appears to have been successful, where the simple section of the nerve had failed; but, like all other operations of this kind, no certain reliance can be placed on it. The practice of introducing escharotics into the bony canals is, however, a most dangerous one, for it cannot be performed without the risk of injuring the bone, so as to cause it to exfoliate; an accident more likely to increase the neuralgia than abate it.

From the above sketch, it will be seen that the chance of relief from an operation is doubtful. It would be an extremely valuable acquisition to our knowledge on this subject, if any rules could be ascertained for resorting to it with a greater certainty as to the result. The symptoms which seem to favour it are—the pain continuing for a considerable period in the same nerve, without manifesting a tendency to change its position; the absence of any obvious cause of a permanent nature, which would be likely to act upon other nerves after the operation, or to renew the pain in the same nerve when the immediate effects of the operation have passed away; such as organic affections of the brain or spinal marrow, tumours, exostoses, &c.

In every case, before the operation is resorted to, the patient should be informed that its effects are uncertain; but we should not be justified in refusing him this last hope of eradicating his complaint, when no circumstance seems to contra-indicate it; although, as Sir Astley Cooper justly observes, "It ought to be performed rather by the earnest desire of the patient, than by the recommendation of the surgeon."

[1] André, sur certains mouvemens convulsifs.

OF THE

PARTICULAR FORMS OF NEURALGIA.

Having gone through (it is feared very imperfectly) the general view of neuralgic affections, it now remains to examine each species separately, dwelling only upon those circumstances of their history, not comprehended in the former part of the work.

Neuralgia Facialis.—The merit of originality in describing this species of neuralgia is very generally assigned to Dr. Fothergill, whose account of a painful affection of the face was published in 1776.[1] This excellent communication was no doubt the means of introducing the disease to the knowledge of the practitioners of this country, and of some parts of the continent; for it was described by many writers of that period, as Dolor Faciei Fothergillii. But, in France, it had previously obtained much notice, in consequence of an admirable treatise by André, a surgeon of Versailles, who published in 1756, and gave this affection its present popular title of Tic Douloureux.[2] It seems also to have been observed by several other authors, nearly at the same time; some of whom wrote prior, and others subsequently, to the appearance of André's publication; although they were not successful in attracting much notice, until the history of the disease became afterwards the subject of more general enquiry.

This neuralgia was described with considerable minuteness by Thouret, the same year that Fothergill's paper appeared in this country.[3] Ludwig and Hoffmann also published well marked cases a few years previously, the former under the title of "De dolore superciliari acerbissimo;"[4] the latter heading his communication—"De Cephalalgia Rebelli."[5]

These various descriptions published nearly at the same period, by physicians in different parts of Europe, might at first sight seem to favour the opinion, that the disease originated about the middle of the last century. It will be observed, however, that some of these cases were communicated through the means of the medical journals, which then first began to appear, affording a facility of disseminating information which was previously unknown. There are, moreover, passages in the works of medical writers of every period, more or less applicable to this affection; although it must be con-

[1] Med. Observ. and Enquiries, vol. iii.
[2] Obs. Prat. sur les mal. de l'Ureth.
[3] Histoire de la Societé Royale de Médicine.
[4] Ephem. Nat. Curios. 1772.
[5] Med. Consult. vol. ii.

fessed, that the descriptions of the ancient physicians generally supposed to refer to it are not always very satisfactory.

Siebold, who wrote a treatise upon the disease, mentions that it had been observed by Degener, in 1724, who published some remarks upon it, under the following title:—"De dolore quodam perraro acerboque, maxillæ sinistræ partes occupante et per paroxysmos recurrente."[1] Degener also supposes that Bausch, the president and founder of the above society, died of the disease in 1665; and from the account of his symptoms, there can be little doubt that this opinion is correct. He had experienced for four years pungent pains of the left jaw, returning in paroxysms, and sometimes ceasing entirely. The pains were upon some occasions so violent, that the patient could neither speak nor eat without undergoing the greatest torture. Previously to his death, he was affected with hemiplegia of the left side.[2]

Sydenham also has given an excellent sketch of the disease in the following passage:—

"Sed neque ipsi dentes (quod vix credas) ab hujusce morbi insultu se possunt defendere; licet neque vel minima cavitas neque humoris alicujus defluxus, saltem qui percipi queat, dolori sive ansam præbuerit, sive vehiculum; qui nihilominus nec mitior est nec contractior aut expugnatu facilior."[3]

In 1829, a manuscript of the celebrated John Locke was presented to the College of Physicians by the late Lord King, in which is detailed the case of the Countess of Northumberland, ambassadress at Paris, in 1677, to whose embassy Locke appears to have been attached as physician. In this curious document, not only are the symptoms of facial neuralgia accurately given, but the true seat of the disease is distinctly referred to.

The description in Cœlius Aurelianus of the disease, called by him Raptus Caninus, has often been supposed applicable to facial neuralgia; but one very essential symptom is altogether unnoticed by this writer, namely, pain: and the violent convulsive motions of the muscles of the face, neck, and shoulders, of which he speaks, can hardly be said to represent the usual character of this neuralgia. The following is the passage alluded to:—

"In ista passione constitutos, sequitur conclusio, sive contractio repentino motu veniens ac recedens sine ulla corporis turbatione, in utrinsque labii ultimo fine, sive oris angulo, ut etiam buccas adducat in posteriorem partem creberrime, tanquam ridentibus, nunc palpebras, vel supercilia ac nares, ut etiam colla atque humeros rapiat, et ita patientes faciat commoveri, tanquam onus humeris bajulantes transferendi ponderis causa."[4]

Aretæus has described a complaint which closely resembles the

[1] Act. Nat. Cur. vol. i.

[2] Siebold, Doloris faciei, morbi rarioris atque atrocis, observationibus illustrati adumbratio, 1795.

[3] Sydenham, Dissert. Epist.

[4] Cœlius Aurelianus, lib. 2, cap. 2.

facial neuralgia. Speaking of headache, he says, "Ejus formæ infinitæ sunt: nonnullis per cercuitus revertitur, ut iis qui quotidiana intermittente febricitant; nonnullis ab occasu solis usque in meridiem; et tunc ex toto remittitur; vel a meridie in vesperam, aut etiam ulterius usque in noctem permanet: sed non multum hæc durat circuitio; præterea, dolor modo est in toto capite, modo in dextra magis, modo sinistra, modo circa frontem aut sinciput; hæcque eodem die incertè atque erraticè fieri solent. Quidam dextra tantum parte dolent, quidam læva, qua tempus vel auris, vel supercilium unum, vel oculus ad medium, usque terminatur, vel quà nasus in æquas partes dividit; ultra quem terminum dolor non progreditur, dimidium tantum corporis occupans; * * * * * haud leve malum; quamvis intermittit, quamvis exiguum esse prima specie videtur; nam si acuté interdum impetum faciat, fæda atque atrocia detrimenta adfert; nervi distenduntur, facies obtorquetur; oculi vel contenti instar cornu rigidi sunt; vel huc atque illuc interius convelluntur, ac vertiginosè agitantur."[1]

Hippocrates has given no distinct history of this affection: he has however, been supposed to refer to it in the following description:—

Phenicis affectio ex oculo dextro talis quidam erat, plerumque velut fulgum elucere putabat. Quum autem non diu ipsum continuisset, dolor ad tempus dextrum instabat, et per totum caput ac collum.[2]

This complaint has received a great variety of names, of which the following are the principal—

Tic-Douloureux	André.
Trismus Dolorificus	Sauvages.
A painful affection of the Face	Fothergill.
Dolor Capitus Intermittens	Heberden.
Neuralgia Facialis	Chaussier.
Hemicrania Idiopathica	Darwin.
Neuralgia Spasmodica	Kerrison.

These different names (and others might be added) are a constant source of mistake and confusion. I have employed the term neuralgia facialis, in compliance with Chaussier's nosology; the addition of spasmodica is objectionable, because it refers either to an obscure theory of the disease, or to a symptom of comparatively rare occurrence, namely, the convulsive motion of the facial muscles during the paroxysms.

Some authors who adopt the term neuralgia in general, still retain that of tic douloureux when the disease appears in its most painful character; but this distinction is of no practical value, and might lead to erroneous impressions respecting the nature of the affection. "Painful affections (Bichat remarks) have been variously denominated, intermitting headache, hemicrania, tic douloureux, &c.

[1] Boerhaave's Aretæus. De Morb. Diuturn, lib. 1, cap. 2.
[2] Hippocrates, De Morb. Popular, lib. 5.

but they appear to be all the same disease, only varying in situation and degree."[1]

This species seems to be the most frequent, as well as the most severe of all the neuralgiæ. The course of the paroxysm is the same as that already mentioned in the general history of the disease, commencing generally with a sensation of heat or cold over the affected parts, with occasional violent strokes of darting pain, the latter gradually becoming more frequent, until the height of the attack.

This affection is principally seated in the branches of the fifth pair of nerves, sometimes occupying the ramification of one of its three principal divisions, without affecting the other; but more commonly, a few superficial filaments only are affected, which do not generally belong to the same nervous branch. It sometimes flies rapidly to different filaments, harassing each in its turn. It may occupy the whole of one side of the face, dividing it accurately, and even attack one half the tongue and one side of the fauces; but in general it is felt over a surface of less extent.

Nothing can exceed the severity of the pain in many of those unfortunate cases; any operation which seems to promise the smallest hope of relief is gladly submitted to. Blisters, moxas, and other external irritants, are voluntarily applied; and it is often with difficulty that the patient is persuaded from resorting to the most severe remedies, upon the mere chance of obtaining some alleviation to his sufferings.

The brain itself, or its membranes, are sometimes the seat of this affection. It has been supposed that hemicrania and periodical headache, where the pain does not possess the peculiar lancinating character of neuralgia, but is dull and obtuse, denote that it belongs to the parts within the cranium. It is certain, however, that this species of headache may originate in the disorders of the fifth pair of nerves, and that causes acting directly upon the cerebral mass, sometimes give rise to hemicrania, at others, to the ordinary symptoms of facial neuralgia. The character of the pain therefore is not a sufficient guide on this point.

Three varieties of facial neuralgia are enumerated by Chaussier, viz.—Frontal, Suborbital and Maxillary.

Neuralgia frontalis.—It is seated in the orbito-frontal branch of the fifth pair of cerebral nerves. The pain commences at the supra-orbital foramen, shoots over the superciliary ridge, and spreads through the upper eyelid to the forehead; it sometimes attacks the inner canthus of the eye, or the ball of the eye, creating in the latter a sensation as if it were bursting. In some instances the corresponding side of the face is also affected. During the paroxysm, the neighbouring arteries pulsate strongly; the veins become prominent, the tears flow abundantly, and sometimes temporary blindness ensues. This species has very commonly a periodical character.

[1] Bichat, op. cit.

M. Piorry has lately described a neuralgic affection, which he calls névralgie irienne ou ophthalmique, where the pains commence, as he supposes, in the nerves of the iris. It attacks persons who dwell in dark apartments; those who read or write much; artisans whose business requires them to fix their eyes continually upon minute objects, &c.

At the commencement of an attack, the symptoms are referred to the eye; the sight is suddenly obscured, or perverted; frequently a dark spot appears before the eye, surrounded by a luminous circle. After an interval of variable duration, generally not exceeding a few minutes, this symptom disappears, and is succeeded by stupor, vertigo, lancinating pains of the eye and temple, and a sensation of pressure over the eye, as if it were too full. About this stage of the attack, vomiting usually occurs, and the paroxysm begins to decline.[1]

Neuralgia Suborbitalis occupies the superior maxillary nerve. Commencing at the infra-orbital foramen, the pain spreads through the cheeks, the upper lip, the alæ nasi, and lower eyelid. Sometimes it attacks other branches of the nerve, darting through the teeth of the upper jaw, the maxillary sinus, the palate, and the root of the tongue, and occasionally extends over the whole of one side of the face. During the paroxysm, the facial muscles sometimes contract spasmodically, and the secretions of the salivary glands and nostrils are increased. The regular periodical type is less frequent in this species, than in frontal neuralgia, the paroxysms being often dependent on the movements of the jaw in speaking and eating.

Neuralgia Maxillaris is seated in the inferior maxillary nerve. In general, the pain begins at the mental foramen, and follows the ramifications of the nerve distributed over the chin and lip; or, passing through the mental foramen, it attacks the teeth of the lower jaw, the side of the tongue, the cheek, temple, and ear. In this species the paroxysms are nearly always irregular. It is less frequently observed than the other forms of facial neuralgia.

The influence of sex in predisposing to neuralgia facialis has been differently estimated by authors. Thouret found it most common among men, whilst, according to the experience of Fothergill, Heberden, Pujol, Meglin, and most other writers, it is more prevalent among women. A large proportion of the cases which have come under my own observation occurred in females.

When the pain is situated in a dental twig of the superior or inferior maxillary nerves, it is not uncommon to meet with patients who have had tooth after tooth extracted, until the gum of the affected side has been completely denuded. Sometimes, the pain is partially mitigated for a short time after the extraction, even

[1] Piorry, sur l'une des Affections désignées Migraine, ou Hemicranie. Pelletan. J. P. Coup-d-œil sur la Migraine.

when no caries existed; but it generally returns in a few hours, with its former or even with increased severity.

John Hunter says, "I have known cases of this kind, where all the teeth of the affected side of the jaw have been drawn out, and the pain has been retained in the jaw; in others, it has had a different effect; the pain has become more diffused, and has at last attacked the corresponding side of the tongue. In the first case, I have known it recommended to cut down on the lower jaw, and even to perforate and cauterise it, but all without effect."[1]

"The dentist," says Duval, "sends the patient to the physician, by whom he is again dismissed to consult the dentist, until at length the greater number of his teeth are sacrificed, and his days are ended in a most deplorable manner."

But on the other hand, in many cases, the symptoms have been found to originate in a carious tooth, even when decayed in a very slight degree, dependent probably upon the inflammation easily excited during that process.

When there is a general decay of the teeth, as is frequently observed in delicate persons, even in the prime of life, the facial nerves are very liable to become affected with neuralgic pains, which in these cases often attack both sides of the face at the same time; but although exceedingly teasing and distressing, the disease, under these circumstances, seldom acquires that intensity, by which it is too often characterised, when it occupies a surface of less extent.

Mr. Swan remarks, that "in old people, the teeth of one gum are sometimes entirely lost, so that those of the other are apt to press very much on the soft parts of the mouth, and produce slight ulceration, which sometimes causes very violent pains, exactly resembling Tic douloureux."

Sir Henry Halford has published some valuable observations, in which the disease was connected with "some preternatural growth of bone, or a deposition of bone, in a part of the animal economy where it is not usually found, in a sound and healthy condition of it, or with a diseased bone."[2]

In one case "the rending spasms, by which the disease is marked, were frequently preceded by an uneasiness in one particular tooth, which exhibited however no signs of unsoundness; on its being drawn, a large exostosis was observed at the root of the tooth, and the lady never suffered more than very slight attacks, and those very seldom afterwards."

Thouret imagined that this affection arose from pressure of the nerves, in consequence of disease of the bony canals through which they pass, but he adduces no facts to support this theory.

This affection has sometimes been found to depend upon a collection of fluid in the antrum Highmorianum, and in some fatal cases, disease has been detected within the cranium.

[1] John Hunter, op. cit.
[2] Sir H. Halford's Essays and Orations.

The late Dr. Pemberton suffered dreadfully from facial neuralgia. Upon a post-mortem examination there was discovered an unusual thickness of the os frontis, and a small deposit of bony matter in the falciform process of the dura mater.

Sir C. Scudamore has detailed the dissection of a patient who had been affected with facial neuralgia for several years, which at length terminated in apoplexy. In the falciform process of the dura mater, a small ossification was found, which excited inflammation, softening of the brain, and effusion.

In a severe case of the disease, situated in the second and third division of the fifth pair of nerves, which Mr. Tyrrell examined, he found "two fungoid tumours originating from the dura mater; one situated on the right side of the sella turcia, and connected with all the branches of the fifth pair of nerves, but particularly the second and third; the other was placed over the cuneiform process of the occipital bone, was the size of half a large hen's egg, and was connected with the other tumour by a process of the same fungoid matter."[1]

Dr. Bright has detailed the dissection of a case, where the pain was seated on the left side of the face, and was seldom completely removed, but became more severe in paroxysms.

"The membranes about the upper part of the brain offered nothing remarkable, but the quantity of serum, both external to the brain, and in the ventricles, was more considerable than is natural. The fifth ventricle was rendered very conspicuous; the brain was softer than in perfect health, and the medullary matter slightly mottled with a light purple cloud. The dura mater, immediately under the anterior part of the left middle lobe, was considerably but irregularly elevated by fungoid tumours, equal, collectively, to about the size of a pigeon's egg. There was a corresponding depression in the substance of the brain, which at this spot was slightly adherent and disorganized, but not completely softened; nor was the raised portion of the dura mater ulcerated or materially altered. The bone beneath the tumour was diseased, and in some parts offered no resistance to puncture; the morbid growth appeared to have extended from the sphenoidal sinuses; the mucous membrane lining all the nasal cavities on that side, were similarly affected, but to a less degree. There was a soft pedunculated polypus, of about the size and shape of a raisin, attached between the turbinated bones. The branches of the portio dura, so far as they were laid bare in the removal of the diseased parts, exhibited no morbid appearance."[2]

The principal value of these dissections appears to be, that they point out the occasional dependence of facial neuralgia, upon organic lesions of the brain or its membranes; but they cannot with

[1] Sir A. Cooper's Lectures on Surgery, vol. ii. Note, p. 407.
[2] Bright's Medical Reports, vol. ii.

any propriety be employed to establish a general theory, respecting the origin of the disease.

Treatment.—The rules of treatment suitable to neuralgia in general, will also be applicable in this particular species; but it will be necessary to make a few additional remarks, especially referable to facial neuralgia.

One of the first questions which the practitioner is generally called upon to decide, in the treatment of this disease, is, whether it is connected with the state of the teeth. This enquiry is often one of considerable difficulty, especially where no caries can be discovered by inspecting the teeth. In these cases, a careful examination into the history of the case becomes essential. Thus, the patient may recollect that previously to the appearance of his complaint, he had experienced pain in a particular tooth, or had observed it to be tender during mastication. The paroxysms may be found to commence or terminate with tooth-ache, or to be excited whenever a certain tooth is struck or otherwise irritated. Under either of these circumstances, the practitioner is fully justified in recommending the extraction of the tooth.

The practice of cauterising the alveolar processes, so as to occasion exfoliation, cannot be too strongly reprehended. This practice might readily excite the disease, but it is not easy to understand how it can cure it.

In some instances, an attempt has been made to relieve this neuralgia, by first extracting a molar tooth, and afterwards piercing its socket, so as to penetrate the antrum, and even injecting stimulating fluids into that cavity, without any rational grounds for such practice.

In a few cases, a collection of purulent matter has been discovered, upon the evacuation of which the disease was cured; but in others, the operation has been entirely useless. It need hardly be remarked, that it should never be attempted, unless when there are good grounds for believing that the antrum contains some irritating substance.

When the symptoms are connected with a general decay of the teeth, it may be often discovered that the principal source of the irritation proceeds from one or two teeth. Under these circumstances, the extraction of the offending tooth sometimes gives great relief. When this treatment fails, I have often succeeded in alleviating the pain, by touching the gums with lunar caustic, at the point which was the apparent source of the pains; at the same time, the general remedies for neuralgia should not be neglected.

In a case, mentioned by Mr. John Scott, where neuralgia of the face and throat was invariably excited by the act of swallowing, Mr. Pennington succeeded in effecting a cure by nourishing the patient for several weeks by means of enemata. The disturbance of the jaw and throat in eating was thus avoided, and the benefit derived was permanent.

But it may be doubted, whether the absolute quietness of the

affected organs, was here the only, or even the chief agent; for the patient became greatly emaciated, and the pulsations of the heart sunk considerably. It is easy to conceive, that these circumstances effect a change in the original cause of the complaint.

Otalgia.—This affection, popularly known as earache, has been well described by M. Itard, in his excellent work upon diseases of the ear.[1] The symptoms consist of acute pain, darting through the course of the chorda tympani, frequently attended with tinnitus aurium, and temporary deafness. In some cases, the pain sends lancinating strokes through the brain; in others, it spreads along the cheeks and temples, and is accompanied by redness of the eyes and a flow of tears; or it may alternate with neuralgia of other organs. It is a common affection in children when they are shedding their first set of teeth; it sometimes arises from enlargement and chronic inflammation of the tonsils, and from the causes common to neuralgic affections in general.

It is exceedingly important to distinguish otalgia from inflammation of the internal ear, for in the latter affection the brain or its membranes frequently become implicated, and fatal consequences might ensue, unless active treatment were speedily employed; yet earache is generally considered so slight a disorder, that it is scarcely thought deserving of medical interference.

Otalgia is distinguished from ottitis by the sudden accession of the pain; by its intermitting; by the absence of any discharge, redness, or swelling in the external meatus, and of febrile excitement; but this diagnosis should not be trusted implicitly, and in doubtful cases the propriety of bleeding and of other antiphlogistic measures should be considered.

It has been recommended in this affection, to bathe the parts with warm water, to apply flannels and poultices to them, and to inject some bland fluid into the external meatus; the practice of employing opiate injections is reprehensible; but M. Itard recommends that a mixture of diluted laudanum should be placed in a small phial, and that the vapour elicited by plunging the phial into hot water be directed into the meatus. A blister behind the ear sometimes gives relief. In other respects the treatment is the same as in other forms of neuralgia.

Neuralgia cervicalis.—This species is of comparatively rare occurrence; it is not included in Chaussier's synopsis.

M. Bousquillon has detailed one case which occurred after opening the external jugular vein; another, observed by M. Jolly, ensued after the application of leeches to the side of the neck.[2]

The case of Hawker[3] is an example of this neuralgia. Sharp pains accompanied by a thrilling sensation were experienced, commencing about the middle of the neck, and following the course of

[1] Itard, Traité des Maladies de l'Oreille.

[2] Dict. de Medecine.

[3] See Case IX.

the principal vessels; both sides of the neck were in this instance attacked at one time, the pain occupying precisely the same situation, and extending to the same point in each, but it was much more severe on the left side; several paroxysms occurred daily.

Neuralgia cubito digitalis, appears to have been first described with accuracy by Cotunnius, who has detailed five cases, all of which he cured by blisters, applied along the course of the affected nerve.

It is seated in the ulnar nerve; the pain generally begins at the upper part of the arm, and sometimes in the axilla; it passes along the inside of the arm and fore-arm, and follows the distribution of the nerve to its termination in the inside of the middle, the ring and little fingers. But the nerve is not usually affected throughout the whole of its course; in some cases the pain is confined to the humerus; in others it commences in the fore-arm, or it may occupy a digital branch alone, and when this happens, the sufferings are often most intolerable.

But in many cases the disease cannot be said to belong strictly to this nerve; for after following it accurately for a certain distance, it is often communicated to other nerves connected with the ulnar, by anastomosis, or even to parts of the arm where this nervous connection cannot be traced.

In some cases, the pain at the head of the humerus is observed to be fixed and constant; and from this point, the paroxysms of neuralgia seem to emanate, shooting down the arm in the manner described.

These attacks are generally periodical, and a paroxysm often comes on towards night. During the accessions, the sufferings are extreme; the arm feels stiff and benumbed, and the patient is obliged to support it with his other hand. In old cases the affected arm sometimes becomes wasted.

Neuralgia supra-scapularis.—The pain begins at the lower angle of the scapula, and extends along its posterior surface; it then ascends towards the dorsum scapulæ, and after winding round the external part of the arm, it reaches the anterior surface, and shooting down the outer side of the arm, terminates in the thumb and fore-finger. This species has been described by Martinet,[1] but its occurrence is extremely rare.

Neuralgia musculo cutanealis.—This species has also been described by Martinet. The pain commences at the shoulder, passes to the external and superior front of the humerus, and afterwards appears on the anterior surface of the arm and fore-arm, and disappears towards the lower extremity of the ulna.

Neuralgia intercostalis.—In this species the pain attacks one or more of the intercostal nerves, sometimes darting from their origin in the spine, to their termination over the breast and sternum; but much more frequently a portion of the nerve only is affected. It is

[1] Revue Medicale, 1824.

seldom observed in the upper part of the thorax, and occurs more frequently on the left side of the chest than on the right.

Neuralgia ileo-scrotalis.—It is seated in the branch of the first pair of lumbar nerves, which passes obliquely towards the spine of the ilium, accompanying the spermatic cord, and ramifying over the scrotum.

Chaussier met with two cases of this affection, in which the pain was extremely acute, returning regularly every day; and was accompanied by shrinking of the scrotum and retraction of the testicle.[1]

From the situation of this affection in the region of the kidney, and its effect upon the testicle, it might be mistaken for nephritis; but the absence of fever and of any morbid deposition in the urine, will generally be sufficient to distinguish it.

Neuralgia of the inferior extremities.—The ancient physicians appear to have included this form of neuralgia, under the general term of Ischias, to which they referred most affections of the lower extremities, where pain is a prominent symptom. Hippocrates, however, seems to allude to it in describing a species of ischias, marked by severe pains of the hip joint, and nates, afterwards descending through the whole limb, unattended with fever, which although troublesome and tedious, was not of a fatal character According to the obscure pathology of that remote period, he imagined it to be the consequence of morbid humours, stagnated in the veins of the affected extremity.[2]

The following passage from Aretæus is well known as being highly descriptive of the sufferings which attends this affection:—

"Initio verò nervi articulorum vincula, et quæcunque ex ossibus exorta sunt, et in ossibus inseruntur, dolere incipiunt, at istorum magnum est miraculum; non dolent quidem vel minimum, etiamsi quis secet, aut collidat; at si quis ab ipsis doleat, nihil aliud est eis ad dolorem citandam potentius, non ferramenta adstringentia, non vincula, non vulnerans gladius, non exurens ignis, nam si hæc assumantur, tanquam majorum dolorum remedia, quod si quis ipsa dolentia ossa preciderit sectionis dolor, ut exiguus a majore obscuratur sin autem iste prevaleat eos voluptas capit priorum malorum oblivionem afferens."[3]

But the same indistinct notions respecting the pathology of this affection, were held by this and all succeeding authors, until its connection with the nerves of the extremities was shown by Cotunnius, an Italian physician who wrote in the middle of the last century. This celebrated author described with great correctness, two distinct species of neuralgia seated in those parts; and adopting from Hippocrates the generic term of ischias, he named one ischias nervosa antica, and the other ischias nervosa postica, the

[1] Tab. Synop.

[2] Hippocrates. De Affectionibus.

[3] Aretæus. De Morb: Diurt: Lib. 2.

former corresponding to neuralgia femoro-pretibialis, the latter to the femoro-popliteal is of Chaussier's arrangement.[1]

Neuralgia femoro-poplitealis is seated in the great sciatic nerve. The pain commences over the sacrum, or about the great trochanter, shoots down the posterior part of the thigh to the knee, and passes over the front of the fibula to the outside of the foot.

At the commencement, the pain is often confined to the sacrum and nates, and does not begin to shoot down the limb until a subsequent period of the disease; sometimes the pain terminates at the knee, in others it begins at the foot, and proceeds upwards along the leg and thigh.

In the beginning of the attack, this affection has most commonly a continued or remittent type, which, as it advances, is gradually changed into the intermittent, a paroxysm mostly recurring towards night.

If it possess an intermitting character at the commencement, Cotunnius observed, that the same was retained throughout; he had never known an instance of the intermittent passing into the continued type.

During the paroxysms, the limb sometimes contracts spasmodically: its veins become prominent, and the valves appear like small knots, which are extremely painful, and often regarded by patients themselves as the source of their sufferings.

The paroxysms are excited by the motion of the limb; by pressure over the affected nerve, and even by the contact of a light substance; by warmth, the patient being often obliged to throw off the bed-clothes, and expose the limb to the cold air.

The causes which act especially in the production of this neuralgia, are—tumours within the pelvis, pressing on the lumbar or sciatic nerves; enlargement of the uterus; scybala in the rectum; hemorrhoids; curvature of the spine, &c.

In a patient who had long suffered severe pain in the course of the peroneal nerve, Sir B. Brodie found a large solid tumour attached to the left side of the lumbar vertebræ, and extending into the pelvis. "It was evident," Sir B. Brodie observes, "that this tumour must have pressed on the origin of the sciatic nerve, and thus it afforded a sufficient explanation of the pain which for so many years had been referred to some of its branches."[2]

A woman, aged fifty-eight, had suffered from an attack of this affection, which continued for several weeks without any mitigation. It was subsequently discovered that the rectum was much distended with fæces, requiring mechanical means for their removal. Afterwards, purgative medicines were administered, and the symptoms disappeared.[3]

A woman affected with a curvature of the spine, experienced severe pain in the great toe of the right foot, for about three or

[1] Cotunnius. De Ischiade Nervosa, 1770.
[2] Sir B. Brodie, l. c. [3] Piorry, l. c.

four hours after each meal, which always disappeared after a free evacuation of the bowels. It was subsequently found that the symptoms were occasioned by the pressure of the false ribs on the sigmoid flexure of the colon, so that the fæces in passing that point, occasioned compression of the lumbar plexus of nerves.[1]

The duration of sciatica varies from a few days to several years. In chronic cases, there is sometimes considerable difficulty in determining between this affection and disease of the hip joint; for the limb may become wasted, and apparently lengthened, in consequence of the relaxation of the muscles.

The following rules for distinguishing these affections are given by Sir B. Brodie.—"The patient is unable to support the weight of the body on the affected limb, and if he be placed on an even surface, in a horizontal position, and the hand of the surgeon be applied to the heel, so as to press the head of the femur against the concavity of the acetabulum, violent pain is the consequence; although this be done in so careful a manner, that not the smallest degree of motion is given to the hip joint.[2]

The same eminent surgeon has described a painful affection of the lower extremities, chiefly occurring in hysterical females, which seems to be a variety of this neuralgia.—"At first, there is pain referred to the hip or knee, or some other joint, without any evident tumefaction; the pain soon becomes very severe; and by degrees a puffy swelling takes place, in consequence of some degree of serous effusion into the cells of the cellular texture. The swelling is diffused, and in most instances trifling; but it varies in degree, and I have known, where the pain has been referred to the hip, the whole of the limb to be visibly enlarged, from the crista of the ilium to the knee. There is always exceeding tenderness; connected with which however, we may observe this remarkable circumstance, that gently touching or pinching the integuments in such a way that pressure cannot affect the deep-seated parts, will often be productive of much more pain, than the handling of the limb in a more rude and careless manner."[3]

The treatment recommended by Sir B. Brodie, is of the same description as that pursued in other hysterical affections.

Neuralgia Pretibialis vel Cruralis is seated in the crural nerve. The pain begins at the crural arch, passes along the anterior and internal part of the thigh, shoots down the front of the tibia, finally disappearing at the inner ankle, or in some of the cutaneous nerves of the foot.

It is much less common than the preceding species.

Neuralgia Plantaris is introduced in Chaussier's Synopsis. The pain shoots from the heel across the sole of the foot, and sometimes affects one or more of the toes; Chaussier had only met with

[1] Portal, Anatomie Médicale, vol. iv.
[2] Brodie, Path. and Surg. Obs. on the Joints.
[3] Brodie, l. c.

one case of this affection, where the pain, which was very acute, followed with great exactitude all the ramifications of the plantar nerve without observing any regular type. After continuing for several months it ceased suddenly, and was succeeded by facial neuralgia; subsequently the pain returned to the foot.[1]

Treatment of Neuralgia of the Inferior Extremities.—The modification of treatment adapted to this species, may be gathered from a consideration of its peculiar causes.

In chronic cases, a careful examination of the pelvic viscera should never be neglected, as it may lead to the detection of tumours, enlargement of the uterus, scybala accumulated in the rectum, &c., occasioning pressure of the pelvic and lumbar nerves; by reducing any unusual irritation of these organs, whether dependent upon organic disease, or merely deranged function, the sciatica may sometimes be relieved.

When there is much disturbance excited, in consequence of hemorrhoids, the sciatic pains may be frequently relieved by subduing the irritation arising from these tumours, and subsequently administering the common remedies of neuralgia.

Much benefit has sometimes been derived in protracted cases by the patient's resolutely persevering in the use of exercise, of which a very striking example is given by Pinel.[2] A gentleman who had long suffered from this affection, and had tried many remedies under the direction of that eminent physician, without the least advantage, was finally cured by resuming the fatigues incident to the profession of a soldier.

In a case communicated by Dr. Marcet, and published in the Medico-Chirurg. Transactions, the pains were removed by the patient's persisting in the daily use of exercise, with his body wrapped up in several folds of flannel. The use of flannel is, indeed, very important, both as a means of cure in chronic sciatica and in preventing a relapse.

The internal exhibition of turpentine has been much praised, especially by the continental physicians in cases of this kind; Martinet succeeded in removing several obstinate cases by this treatment, and M. Dufour cured six patients with the same remedy. Turpentine has also been employed advantageously in the form of an injection, or as an external application.

The exhibition of opiate enemata or suppositories, has also been found beneficial in this disease.

Neuralgiæ mammæ.—This affection was, I believe, first arranged among the neuralgiæ, by Dr. Good, but it does not appear to have been generally regarded by the profession, until Sir A. Cooper published his excellent description of the disease, which he denominated the Irritable Breast.[3]

[1] Table Synop.
[2] Pinel, l. c.
[3] Sir Astley Cooper on Diseases of the Breast.

The pain occupies the substance of the mammary gland, and is not generally accompanied by swelling, or indeed by any other external sign of disease; in old cases, however, the gland is sometimes observed to be larger than is natural. It chiefly attacks young persons, from puberty to the age of thirty; Sir A. Cooper never witnessed a single case prior to the former period. He says, "When the complaint affects the glandular structure of the breast, there is scarcely any perceptible swelling, but one or more of its lobes become exquisitely tender to the touch; and if it be handled, the pain sometimes continues for several hours. The uneasy sensation is not confined to the breast alone, but it extends to the shoulder and axilla, to the inner side of the elbow and to the fingers; it also affects that side of the body, even to the hip; the patients cannot sleep on that side, and the pain is so severe as to prevent even their resting on the diseased side; and the weight of the breast in bed in some instances occasions intolerable pain. Patients also state that heat and cold frequently succeed each other in the breast; and it would seem the pain resembles that in the tic-dolourcux, darting like electricity through the neighbouring nerves. When the pain is most severe the stomach sympathises and vomiting is produced. The suffering is very much increased prior to menstruation, and is somewhat relieved during the period, and decreased after its cessation. There is no external mark of inflammation, as the skin remains undiscoloured."

"In some cases a small portion of one breast is affected; in others the whole, and, not unfrequently, both the breasts. This painful state continues for months and even for years with little intermission; but it has no malignant tendency, and an operation where there is no distinct tumour must be entirely out of contemplation."

One case of this affection seems to have been observed by Willis, although he evidently regarded it as having a malignant character, an opinion which is disproved by the age of the patient and the manner in which the disease terminated.

A young lady, sixteen years of age, received a severe contusion of the left breast, by falling from her horse upon a projecting stone; the bruise got well rapidly, and for a long time her health was tolerably good; but about three years after the accident she began to suffer severe and almost constant pain of the breast, which was slightly swollen; she could not endure it to be touched, or, indeed, the least noise or shaking in the bed-room. Various lotions and cataplasms failed to give her ease; sometimes the gland was attacked with spasms, and pains flying in every direction; and often a long train of hysterical symptoms ensued.

At first these paroxysms were transient, and only excited whenever the breast was irritated; but subsequently they became more frequent, and at length periodical, returning regularly twice a day at the same hour.

After passing six months in this miserable state, under the care

of different physicians, she removed to Bath, where her sufferings were somewhat mitigated by drinking the waters; she married shortly afterwards, and gradually recovered during her pregnancy.[1]

A mitigated form of this affection is by no means uncommon. Some women have great tenderness of the mamma, at each return of the catamenia; it frequently attends even slight cases of uterine derangement; but happily, the sufferings seldom amount to that high degree of intensity just referred to.

Treatment.—Sir A. Cooper recommends that the affected gland should be covered with a plaster, composed of equal parts of soap, cerate, and extract of belladonna, or a poultice with a solution of belladonna and bread. Oil silk should be worn upon the breast, or hair skin or some warm fur; by the perspiration thus excited the part is soothed and tranquillised.

Much benefit may be derived, at least in the milder form of this affection, by the application of leeches, or by cupping over the sacrum, or in the uterine region; I have often seen the symptoms disappear under this treatment when no application has been applied to the breast.

NEURALGIA OF INTERNAL ORGANS.

Every person who studies the phenomena of disease, without the intervention of theory, must admit that the internal organs are subject to complaints which are attended with severe pains, yet produce no change of structure in the part affected.

There is so close an affinity between internal affections of this description, and neuralgia of external organs, that it is surprising they were not universally perceived to be the same disease, modified by the situation and function of the affected parts. This is more remarkable, as Fothergill suggested their probable identity in his paper on facial neuralgia. "There are (he says) few physicians, I believe, who may not, in reviewing many cases which have occurred to them, of anomalous pains in different parts of the body, so as sometimes to counterfeit gouty, bilious, and other internal affections of the stomach and bowels, perceive some analogy between them and the complaint here pointed out."

This form of neuralgia seems to have been described by the older medical writers under the term rheumatismus scorbutus, as will appear from the following passage from Sydenham:—

"The pain seizes sometimes this part, sometimes that; but seldomer occasions swelling than the other kind (of rheumatism), neither is it accompanied with a fever, nor is it fixed so long, but is of a more wandering nature, and has irregular and disorderly

[1] Willis. Opera Omnia, 1682.

symptoms,—now it afflicts this or that member, by and by it only seizes the inward parts and occasions sickness, which goes off again when the pain returns to the outward parts, and so afflicts the patient by turns, and continues a long while like those diseases that are reckoned most chronical. It chiefly seizes women and men of a weakly nature."[1]

It would be difficult to name any circumstance in the history of those internal pains which does not bear a strong analogy to neuralgia: like it they are often represented as lancinating, cutting, &c., and aggravated by slight, and are increased by firm, pressure; they return in paroxysms, which are succeeded by an interval of ease; there is generally no symptom of febrile action, and, notwithstanding the severity of the pain, the general health is but little impaired, and even the functions of the affected organ are healthily performed during the intervals of the attacks.

A resemblance to neuralgia may also be observed, in many cases, in the sudden subsidence of acute pains of an internal part, which had occasionally tormented the patient during the greater part of his life; where the affected organ subsequently evinced no sign of disease; and where, even after death, no morbid appearance could be discovered in the viscus, so long the seat of most intolerable pain.

The nature of this affection becomes still more apparent in cases where external neuralgia alternates with visceral pains, or acute pain of an internal organ is suddenly replaced by external neuralgia.

The exciting causes of this nervous affection, are mostly the same as those enumerated in the general history of the disease; but it seems to be in an especial manner under the influence of mental causes, being often excited by anxiety, depression of spirits, fear, &c. It sometimes arises from irritation acting upon the external surface of the body, as mechanical injury of a nervous twig, &c.

Neuralgia of the organs of respiration and circulation.—*Angina pectoris.*—Since the publication of Heberden's paper on this subject, in 1768,[2] no disease has more engaged the interest of medical practitioners. The admirable history of its symptoms, given by that eminent physician, deserves all the praise of originality, having been written entirely from his own observation. The disease had, however, been previously noticed by some other authors, and is distinctly alluded to by Sauvages, who placed it in his nosology under the title of cardiogmus cordis sinistri.[3]

The writers on this subject, subsequently to the appearance of Heberden's communication, have been very numerous, many of whom have given a name to this disease according to their fancy, generally suggested by its most remarkable symptom, viz. painful constriction of the chest.

Several pathological theories respecting this affection, have also

[1] Pechey's Sydenham. p. 204.
[2] Transactions of the College of Physicians, vol. ii.
[3] Cyclo. of Pract. Med. Art. Angina Pectoris by Dr. Forbes.

been advanced at different times, which further experience has tended to disprove, and the opinion now prevails very commonly, that angina pectoris is a form of neuralgia, not necessarily connected with structural disease of the heart or large vessels, although very frequently accompanied by lesions of these organs.

Like other kinds of neuralgia, this disease attacks in paroxysms, that are for the most part irregular; at first the intermissions are of long duration, and sometimes even several years intervene between the first attack and the subsequent one; but they afterwards become more frequent, being excited by any moderate exertion, such as walking against the wind, or over elevated ground; by talking; by mental excitation, especially sudden surprise or alarm; and in some cases, the patient is attacked when he remains calm and quiet, or even during sleep; the attacks are also more readily excited after meals.

The paroxysms commence with a feeling of constriction of the chest, accompanied by acute pain over the lower portion of the sternum, extending to the left side of the thorax, and the inside of the left arm so far as the elbow. In some cases, the pain runs along the course of the brachial nerves to the fingers, and even over the whole of the left side of the chest; sometimes two or three successive strokes of lancinating pain, appear to plunge through the substance of the heart.

The respiration is seldom much impeded; but deep involuntary sighing generally accompanies the attacks; the countenance grows pale, the skin becomes chilled, and the patient has a dreadful sensation, as of approaching dissolution; the pulse generally becomes small and feeble; in some cases, however, it acquires strength during the paroxysms; sometimes its velocity is increased, at other times it becomes slower than natural. The attacks usually terminate with an eructation of gas from the stomach.

The stethoscope does not always indicate any unusual action of the heart during the accessions. In one instance, I have observed that it always beats violently against the ribs when an attack occurs, whilst at the same time the pulse at the wrist becomes sensibly smaller.

With regard to the nerves which are the seat of angina pectoris, there is still considerable uncertainty; it has been assigned by different pathologists to the phrenic, pneumo-gastric, sympathetic, and intercostal nerves. In most cases, branches from the brachial and cervical plexuses, and sometimes more distant nerves are also affected, either sympathetically, or from their anastomosis with the nerves which are the principal seat of the complaint.[1]

This disease is much more frequent in men than in women. Of eighty-eight cases collected by Dr. Forbes, no fewer than eighty occurred in men. It seems to be more prevalent in the later periods

[1] Laennec de l'Auscult: Médiate, vol. ii; Bouillaud, Traité Clinique des Mal. du Cœur.

of life, and seldom attacks persons under the age of fifty. Patients of a gouty habit, and those who indulge in indolence and luxury, are said to be particularly liable to its attacks. I have seen some cases, which were apparently occasioned by long continued and active exertion.

The results derived from morbid anatomy respecting the cause of this affection are far from being uniform. In several cases, the coronary arteries have been found ossified, and this lesion was formerly supposed to constitute the true pathology of the disease, an opinion which is still entertained by some physicians. In many instances, however, these vessels have been found perfectly free from disease. Laennec examined the bodies of several patients who died of angina, but did not find the coronary arteries ossified in a single case; and, on the contrary, these vessels have been often observed in a diseased state, where no symptoms of agina pectoris had been noticed.

In other fatal cases the heart has been found dilated or hypertrophied, or with its valves ossified; in others, it has been discovered paler than natural, or softened, or embedded in an unnatural quantity of fatty matter.

But in some instances the heart and its appendages have retained their normal appearance. Sometimes, the only morbid change discovered has been enlargement of the liver, or spleen, or tubercles in the lungs; whilst in others, no alteration of structure could be detected in any part of the body.

From these considerations, it may be doubted whether angina pectoris is necessarily allied to organic changes of the heart or primitive vessels; or indeed, whether there is a certain definable lesion of any organ which invariably gives rise to it, or which is required for its development. Nor is it by any means well ascertained, that the alterations in the structure of the heart observed in many cases, are not the consequence of its continued functional derangement; or at least, that the latter has not occasioned the extension of mischief originally of small extent.

In a case which I have had an opportunity of closely watching from its commencement, about three years ago, the rhythm of the heart could not be distinguished during the first attacks, even in the precordial region, although it can now be heard distinctly over the whole anterior portion of the chest.

If the principles which seem to determine the production of neuralgic affections generally, be applied to the explanation of the symptoms of angina pectoris, they will lead to the following conclusions:—That many cases are to be ascribed to mechanical irritation of the cardiac nerves, by distension of the great vessels, when exertion is made, or when the circulation is otherwise accelerated; whilst in others, the changes in the structure of the heart, are to be regarded as the means of determining the irritation excited by some other cause to that organ, rather than as the origin of the disease.

In the case of M. Piorry, already mentioned, where the patient

complained of neuralgic pains darting through the heart, it was discovered that the primary cause of the symptoms was a carious tooth. The heart was indeed largely hypertrophied, but the pains referred to it entirely ceased as soon as the tooth was extracted.

The prognosis in angina pectoris must generally be unfavourable, especially when the patient is advanced in life, and when there is extensive disease of the heart or large vessels. In its most aggravated form, sudden death is to be apprehended. In slight cases, however, a recovery may be fairly anticipated.

In the treatment of this affection, the necessity of avoiding every circumstance which has a tendency to excite the circulation should be impressed upon the patient. His mind should be kept uniformly tranquil, and whenever retirement from the active duties of life is practicable, the importance of this step should be insisted on. Exercise of the most moderate description should alone be employed; and, in severe cases, should be restricted to a quiet drive.

The diet should be light and unstimulating; and care should be taken not to distend the stomach with food so as to occasion pressure of the thoracic viscera. In general, mild purgatives are required to keep the bowels freely open.

The greater number of practitioners agree in condemning the employment of venesection in this complaint. In some cases, however, where the patients were plethoric, this practice seems to have had the effect of diminishing the intensity of the attacks, and protracting the length of the intermissions.

Laennec speaks with much praise of the application of the magnet to the chest, as a remedy for angina pectoris. Issues, either in the side or the extremities, may be found advantageous in some cases. Dr. Davies recommends the application of a belladonna plaster to the chest, from which he has observed much benefit; especially when the disease is not complicated with organic affections of the heart.[1] All the other remedies recommended in the treatment of neuralgia, may also be tried in this complaint.

During the paroxysm, the patient should be placed in a reclining posture; and a draught containing ammonia, camphor, æther, opium, &c. administered.

Neuralgia of the arteries.—Pains, more or less acute, are sometimes observed to follow the course of the arteries, which Laennec conceives to be seated in the nerves proceeding from the ganglionic system to these vessels. These pains, he observes, are either intermittent or continued, but are less severe than similar affections of the cerebro-spinal system.

But the arteries of the limbs are supplied by the spinal nerves, and the severe pain which is sometimes observed along their course, indicates that it is derived from a source more sensitive than the sympathetic nerve appears to be. This subject, however, deserves

[1] Dr. Davies on Diseases of the Lungs and Heart.

further investigation. These pains may sometimes be relieved by the application of a blister in the course of the affected artery."[1]

Neuralgia of the organs of digestion.—Gastralgia.—This affection is marked by paroxysms of pain commonly described as lancinating, tearing, or burning, situated in the region of the stomach, and frequently extending to the thoracic parietes and to the back. It presents every degree of intensity, being sometimes merely a sensation of slight uneasiness, or of constriction in the epigastrium, whilst, at others, the sufferings are of the most acute description. The duration of the attacks is also extremely various. In general, they do not continue longer than a few minutes, but are occasionally prolonged to several hours; they often terminate with a copious secretion of gas, either alone or mixed with a quantity of limpid fluid, which rises spontaneously to the mouth, being sometimes insipid, but at others having an acrid taste. Notwithstanding the disturbance in the principal organ of digestion, that process is seldom materially disturbed; the tongue generally remains clean, and the appetite good, and, in some cases, it is voracious;—the bowels are mostly constipated. The pain is often relieved by food; —there is usually no thirst, or excitement of the pulse, or any other febrile symptom; and although the disease may have existed for many years, the patient often continues to bear the aspect of health.

The length of the intermission or remission varies in different cases; two or more attacks sometimes recur daily at regular periods, in other cases the intervals are much longer and are irregular.

Gastralgia may be mistaken for chronic gastritis. By contrasting with the foregoing description the following sketch of the latter affection the diagnosis will be apparent, at least in common cases.

In chronic gastritis the pain is obtuse and confined to the epigastrium; it is increased by pressure, and aggravated by ingesta; it has no regular intermission; the tongue is commonly parched, and red at its tip and edges, with incrustation on its centre; the breath is fetid; the mouth foul; there is much thirst, and a continual desire for cold drinks. The appetite is bad, and the sight of food disgusting, and when swallowed it is almost instantly rejected. If it remain in the stomach, digestion is imperfectly performed, and is attended with acid or fetid eructations and febrile excitement.

The causes which act particularly in the excitement of gastralgia are—long abstinence, especially when the mind is anxious; an insufficient diet, with regard either to the quantity or quality of the aliment; uterine disturbance; irregular action of the heart, causing irritation of the pneumo-gastric nerves; pressure against the epigastrium, as required in the employment of certain artisans, such as shoemakers, weavers, &c.

[1] See Laennec. De l'Auscultation Médiate. Copland's Dict. of Pract. Med. art. Arteries.

Enteralgia.—In most points of its history this affection resembles the preceding species. It occurs in a great variety of forms, and is, under one or other of them, very commonly met with.

Sometimes there is merely an unpleasant sensation of heat or weight, or trembling in the abdominal region; often recurring at regular periods, or appearing whenever the mind of the patient is unusually depressed.

Sometimes it has an acute character, the patient being seized suddenly with violent pains of the abdomen, which twist round the umbilicus, and return in frequent paroxysms; but the attack seldom continues beyond a few hours. The common colic is an example of this form of the disorder.

In other cases the pains are continued for several days, closely imitating the symptoms of peritoneal inflammation, but having in general well marked exacerbations; they are often aggravated by pressure, and accompanied by considerable excitement of the pulse and symptoms of general disturbance.

This form is commonly observed in hysterical young women, about the periods of the catamenia, or in connection with uterine disorders; but it often occurs from other causes, and well marked cases are sometimes observed in young men, even when of robust make.

The diagnostic signs of this affection have already been examined; but it may here be repeated, that in doubtful cases, the only satisfactory mode of ascertaining its real nature, is to watch the effects of different plans of treatment.

The intestines are also subject to a chronic kind of enteralgia, which may be prolonged to many years, without effecting any visible change in the health of the patient. The pain generally occupies the same region of the abdomen, recurring at intervals of longer or shorter duration; the paroxysms are either intermittent, remittent, or periodical.

Treatment of Gastralgia and Enteralgia.—The importance of strict attention to diet in these disorders must be evident: the pains are often excited in individual cases by certain articles of food, not generally of an irritating character. Whenever this idiosyncracy prevails, it should be strictly attended to, and the patient should carefully avoid partaking of the substance which he has learned from experience is apt to excite the return of his disorder. In other respects, he may be allowed in moderation any plain food.

A removal from accustomed scenes and employments is often productive of great benefit; indeed the effect of traveling on this complaint is sometimes very remarkable. I am acquainted with a gentleman who resides at some distance in the country, who is subject to a troublesome sensation in the region of the cœcum; the attacks continue about three or four hours daily. Upon several occasions he traveled to town for the purpose of seeking medical

assistance, but before he arrived at the end of his journey the symptoms generally disappeared.

A curious example of this kind is reported by Barras, in the case of a guard of the malle-poste, who was affected with chronic enteralgia. His complaint never troubled him on the days that he traveled, but invariably recurred on his resting days.[1]

I have found no medicine of greater efficacy in warding off the paroxysms of enteralgia and gastralgia (particularly the latter) than the extract of nux vomica. The bismuth is often beneficial, either alone or combined with rhubarb, as recommended by Dr. Abercrombie, who also speaks favourably of a combination of sulphate of iron, aloes, and aromatic powder.

Some cases require no further treatment than the regular administration of purgatives, so as to remove the constipation incidental to this complaint. Tonic and alkaline medicines, or a combination of a bitter infusion with mineral acid, are sometimes useful.

Dr. Elliotson has published a large number of cases where gastric pains were successfully treated with hydrocyanic acid, which is now generally regarded as one of the best remedies in this disorder; its exhibition is sometimes followed by an immediate cessation of the pain; but it seems to be far more valuable where the pain is seated in the stomach itself, than in enteralgia.

Opium, belladonna, conium, oil of cajeput, and other remedies, already mentioned when considering the general treatment of neuralgic affections, may also be tried with advantage.

Sometimes a cure is effected by means which could not a priori be supposed to act beneficially in this disease. I have known, for instance, two cases where chronic enteralgia was relieved by the habitual use of cider.

Hepatalgia.—The symptoms of this affection are, pain in the right hypochondrium, extending to the back and thorax, generally recurring in paroxysms, which in some instances are attended by a copious secretion of bile. The bowels are generally constipated; the alvine evacuations and the urine retain their natural appearance.

In some cases it might be difficult to prove whether these pains are seated in the liver, or merely in the abdominal parietes; in others, the evidence of hepatic derangement cannot be disputed.

Andral examined several patients who died with the skin coloured with jaundice, although the liver was found in a healthy condition, and the biliary ducts completely pervious. These cases (he supposes) are nothing more than neuralgia of the hepatic plexus.[2]

Hoffmann had a patient who was subject to paroxysms of acute pain in the right hypochondrium, which recurred daily, each attack being invariably followed by icterus; but the latter was of a

[1] Barras. Traité sur les Gastralgies et les Enteralgies.
[2] Andral, Clinique Médicale, vol. iv.

very evanescent character, and after a few hours the skin resumed its natural appearance. The pains were extremely acute, but were not accompanied by cough or dyspnœa, and were followed by intervals of perfect ease.

Subsequently this patient was attacked with excruciating pains of the teeth, ("dentium tormenta,") which regularly alternated with the hepatic pains, so that when one came on the other disappeared.[1]

The exciting causes of hepatalgia have not been hitherto much observed, but they are most probably the same as those of other neuralgic affections.

The functions of the liver are readily disturbed, in consequence of mental agitation or of cerebral disorder; and some remarkable cases are recorded, where jaundice was suddenly produced from fear, or from an injury of the brain.[2]

Andral had a patient who, for a short time before his death, suffered acute pain in the region of the liver, which was accompanied by icterus, and the latter affection was present when he died. No trace of calculus could be detected either in the biliary ducts or the gall-bladder; and the only morbid appearance was dilatation of the cavities of the heart.[3]

A lady, aged forty-five, had for several years been subject to hemorrhoids, giving rise to pains in the course of the sciatic nerve. Some time afterwards she began to experience acute pain in the hepatic region, which never left her entirely, but became greatly aggravated towards night; no enlargement of the liver was indicated by percussion. After a trial of bleeding, baths, antispasmodics, &c., without benefit, the quinine was administered in doses of twelve grains, which had the effect of first retarding the accessions of pain in the right hypochondrium, and finally preventing their return.[4]

Hepatalgia may be distinguished from hepatitis by the absence of fever; by its intermitting character; and especially by the disposition of the pain to change suddenly from the liver to other parts of the body.

It is more difficult to distinguish this affection from the irritation occasioned by the passing of a gall stone. It is quite possible for the latter circumstance to occur without its being observed by the patient, and without causing jaundice or altering the colour of the dejections; this has happened repeatedly where the subsequent history has put the nature of the case beyond doubt. Hepatalgia may, however, be suspected when the pains recur at regular periods, and the icterus is sudden and transient. An enquiry respecting the duration of the symptoms, and whether the patient has suffered

[1] Hoffmann. Consult. Med.

[2] See Morgagni. De causis et sedibus Morborum, vol. iii. epist. xxxvii.

[3] Andral. Clin. Méd. vol. iv.

[4] Piorry Clin. Méd.

from other neuralgic affections, might also assist the practitioner in his diagnosis, which in all fresh cases must be attended with much difficulty. The treatment required in this affection is similar to that which is employed in enteralgia.

Neuralgia of the Urinary and Genital Organs. Nephralgia.—This term is generally employed to denote the symptoms occasioned by the irritation of a renal calculus; there can, however, be no doubt that the kidneys are sometimes the seat of pains which are totally unconnected either with calculus or inflammation, but possessing a purely nervous origin.

Sydenham, in his history of hysterical affections, has detailed the symptoms of this disorder with his accustomed precision. "Quandoque hoc malum in alterutrum ex renibus incursans, atrocissimo, quem illiic parit, dolore paroxysmum nephriticum omnino mentitur, idque non solum doloris genere locoque, quo sævit, sed et adscitis vomitionibus immanioribus, tum etiam nonnunquam ex eo, quod dolor per ureterum ductus propagetur ita, ut ægré admodum diognosci queat, utrum hæc symptomata ab incluso calculo, an vero ab effectu aliquo hysterico enascuntur."

A remarkable instance of this affection is given by Dr. M'Culloch. His patient had suffered from neuralgia in various parts of the body, which at length attacked the kidneys, and was accompanied by diabetes mellitus. "Respecting this part of the disease (he adds) that it was rigidly paroxysmal, or that the morbid secretion of sugar commenced with the fit, and entirely disappeared in the interval."

The following case was considered as an example of this affection, from the severity of the pain in the neighbourhood of the kidneys, and the absence of any other evidence of disease.

Michael Loftus (painter and glazier), aged forty-two, suffered for several months from acute pains over the left kidney, occasionally extending to the umbilicus, and sometimes attacking the same situations on the other side of the body, described as thrilling and shooting: it never left him entirely, but was greatly aggravated in irregular paroxysms, especially after walking much; the pulse and tongue were natural and the general health good. There had been no retraction of the testicle, nor could any morbid appearance be detected in the urine. He was cupped, and blistered repeatedly over the loins, and various other remedies employed, but no benefit ensued. It was, therefore, determined to try the endermic method. A blister having been applied over the seat of the pain, on the left side, about half a grain of strychnine was sprinkled over the abraded surface; the pain was much easier on the next morning, when the same quantity of alkaloid was applied; and this was repeated until the blistered surface had so far healed as to prevent the application being continued longer with advantage. This happened upon the fifth day, when the pain entirely disappeared from the left side, but was still felt on the right, where it was even more severe than formerly; the same treatment was therefore employed

there, and with the same result. He continued free from pain for several weeks afterwards, when I lost sight of him.

Nephralgia may be distinguished from nephritis by the absence of fever—by the paroxysmal character of the pain—and by there being no retraction of the testicle.

Between this affection and the pains arising in consequence of renal calculus, the diagnosis is more difficult. All the symptoms of nephralgia generally accompany the latter; but in addition, there may be others which denote its peculiar nature, particularly the morbid depositions in the urine, which, indeed, afford the best grounds of diagnosis.

The same general treatment is applicable in this affection as in the preceding neuralgia.

Neuralgia of the neck of the bladder and urethra.[1]—In this affection the pains shoot through these parts, sometimes extending over the loins and sacrum, and are attended by a sensation of heat and itching in the urethra, especially at the extremity of the penis; the paroxysms excite the urgent necessity to make water, although there is often great difficulty in passing it. It is often thrown out in jets, or the stream is suddenly stopt.

The attacks are frequently periodical, either recurring daily at a certain hour (generally night or morning), or every second or third day. During the intermissions, the patient is free from pain, and the urine is passed without difficulty. In old cases the attacks are more frequent, and are generally irregular.

It often occurs without any appreciable disease, either of the bladder or of the neighbouring organs; and indeed, without any evident cause. It may be excited by venereal indulgences, by gonorrhœa, by irritating injections, by the frequent use of catheters, by constipation, or by an acrid state of the urine. It may also arise from organic disease of the urinary apparatus, from calculus in the kidney, or bladder, catarrh of the bladder, strictures of the urethra, enlargement of the prostrate gland, or from affections of the rectum or uterus.

By far the most important consideration connected with this affection, is to decide whether the symptoms are dependent upon the presence of a stone in the bladder. This diagnosis is often one of great difficulty, and the operation of lithotomy has sometimes been performed unnecessarily, in consequence of an erroneous opinion as to the nature of the case.

The surgeon should be apprised, that the severe pain and the sudden stopping of the urine, commonly supposed to be the immediate consequence of the contact of a stone with the lining membrane of the bladder, is often a secondary affection; and may arise from causes exterior to that viscus. But the presence of a calculus may be suspected, when the accessions are irregular, and the

[1] See Abernethy on Diseases of the Urethra. British and Foreign Med. Review, 1837, page 231.

intermissions incomplete; when the pains are excited by the patient standing erect, and relieved when he assumes a reclining position; when the urine will not flow without a change of posture, and then passes in a full stream; but the only satisfactory method of ascertaining the real nature of the case is, to explore the bladder by means of the sound.

Treatment.—M. Civiale cured many cases of this neuralgia, by the repeated introduction of bougies into the bladder; in some instances, the pains were checked at once, by passing a sound, for the purpose of ascertaining the existence of calculus; but M. Civiale recommends the employment of the soft bougie, of moderate size, at the commencement, which should be kept in the bladder about ten minutes and then withdrawn. This operation is to be repeated every day, gradually using a bougie of larger dimensions, until one of the full size can be introduced without pain or difficulty.

When this treatment has been tried without benefit, M. Civiale advises the injecting of water into the bladder, the temperature of which should be gradually reduced. Blisters or irritating ointments applied over the pelvis or perineum, sometimes prove beneficial. When the cause can be ascertained, the treatment must be varied according to the affection with which the neuralgia is associated.

When there is a superabundance of acid in the urine, alkaline diuretics should be tried. Constipation should be removed by a course of purgative medicine; the pains may sometimes be palliated by opiate injections or suppositories, fomentations, warm bathing, &c.; a trial may also be made of the other remedies generally found beneficial in neuralgic affections.

Neuralgia of the testis.—Sir Astley Cooper has published an excellent history of this affection, as it appears in its most aggravated form, to which he has given the name of The irritable testis. The following is his description of its symptoms:—

"The patient has an unnatural sensibility in part of the testicle or epididymis; it is extremely tender to the touch, painful on exercise, and unusually sensitive at all times.

"Its sensibility becomes occasionally so much increased, that the slightest touch produces the most exquisite sufferings; the pain is felt in the back and groin. The motion of the testis, and the slight pressure it receives from the clothes in walking, produce so great a degree of pain as almost to forbid exercise; and the patient is obliged to seek relief by continually reposing upon a sofa, or by remaining in bed. The testicle is but little swollen; it is not equally tender in every part, but there is a point in which the morbid sensibility particularly resides; the epididymis and spermatic cord also suffer from similar sensibility, and if the part be not supported, the pain is scarcely tolerable; and when the patient is in the recumbent posture, he is obliged to place himself on the opposite side to the disease, or he does not rest; he has pain in the groin and thigh upon the same side, and the testicle appears fuller

and more loaded than the other; motion in most cases, produces not only pain at the time, but much increased inconvenience for some hours afterwards; the pressure of the hand in examining it, occasions great uneasiness, and leaves the testis additionally sensitive. The stomach is rendered extremely irritable, even to the degree of occasioning vomiting."

The distress which attends this affection, is in some cases so intolerable, that the patient urges the surgeon to attempt a cure by means of an operation. Sir Astley Cooper has removed the testicle in three cases, at the earnest entreaty of the patient; and in all of them he was completely successful in eradicating the disease.[1]

Barras was at one time of his life affected with neuralgia of the spermatic cord just below the inguinal ring, which, after having for four years resisted every remedy, was finally cured by the application of moxas over the seat of the disorder.[2]

I have never seen this neuralgia in the very severe form alluded to in the above description. In Cummin,[3] who was subject to neuralgic pains in various parts of the body, the testicle was once attacked for a few minutes; he described the suffering as beyond comparison greater than that which the complaint had occasioned in the other organs.

But cases where the pain is of a less intense description, and more under the control of remedies, are frequently met with, occurring in some patients upon any slight derangement of the bowels, or of the general health.

Treatment.—Sir Astley Cooper recommends the exhibition of calomel and opium, until the salivary glands are slightly affected, giving at the same time, the decoct. sarsap. comp. He also recommends a blister to the groin, which is to be kept discharging by means of stimulating ointments; evaporating lotions may be applied also to the testicle.

The operation of removing the testicle does not afford the sure means of extirpating the disease; and although in the cases of Sir A. Cooper, this object was obtained, it cannot always be relied upon. Professor Russel has detailed three cases of this disease, which occurred in Edinburgh. In the first, the testicle was removed, with the effect of giving immediate and permanent relief to the patient; in the second case, the operation was also attempted, but scarcely any mitigation of the suffering ensued; in the third, the symptom disappeared spontaneously, after all treatment had been hopelessly abandoned.[4]

Judging, therefore, not only from these cases, but also from the habitudes of neuralgic affections in general, we may conclude, that the operation should not be hastily performed, nor until the disease has continued so long as to render a cure nearly hopeless by other

[1] Sir Astley Cooper on Diseases of the Testis.
[2] Barras, l. c.
[3] See Case vi.
[4] Russel on the Testicle.

means; and never without making the patient fully understand the uncertainty of the result.

Hysteralgia, Neuralgia of the uterus.—The irritable uterus.—The late Dr. Gooch has given an admirable description of an affection, styled by him, the irritable uterus, which appears to be an aggravated form of Hysteralgia.—"A patient who is suffering from the irritable uterus, complains of pain in the lowest part of the abdomen, along the brim of the pelvis, and often also in the loins. The pain is worse when she is up and taking exercise, and less when she is at rest in the horizontal posture; in this respect it resembles that of prolapsus uteri, but there is this difference, that in the latter, if the patient lies down, she soon becomes quite easy; but in the complaint of which I am speaking, the recumbent posture, although it diminishes, does not remove the pain. It is always present in some degree; and severe paroxysms often occur, although the patient has been recumbent for a long time. If the uterus is examined, it is found to be exquisitely tender; the finger can be introduced into the vagina, and pressed against its sides without causing uneasiness, but as soon as it reaches, and is pressed against the uterus, it gives exquisite pain."[1]

Besides this extreme degree of suffering, there appears to be another form of the disease of very common occurrence, in which the symptoms immediately referred to the uterus, are of a much milder character, so that they are often overlooked altogether, being absorbed in the violent pains of distant organs, to which this affection gives rise, usually denominated hysterical.

These sympathetic pains are observed in all parts of the body;—indeed, the disposition to wander, which more or less belongs to all neuralgic affections, is particularly remarkable in that which originates in the uterus. Sometimes the lower extremities are affected; sometimes the thorax; especially underneath the left breast; but most frequently, some part of the abdomen is attacked, particularly the right and left hypochondria, the region of the cœcum, and the descending colon. These pains are often very severe, giving rise to the suspicion of acute inflammation in the organs where they are situated.[2]

In many of these cases, there is, especially at the commencement, evident derangement of the uterine functions; such as leucorrhœa, dysmenorrhœa, bearing down sensations, pain over the sacrum and loins, &c. Often too, where an examination of the womb is practicable, this organ will be found in a state of morbid tenderness.

This train of symptoms is commonly observed in young girls, approaching the period of puberty; it often appears at every return of the catamenia; or from other causes which excite uterine irritation.

It may proceed from congestion or chronic inflammation of the

[1] Dr Gooch on Diseases peculiar to Women.
[2] See Dr. Addison on the Disorders of Females.

womb; from tumours, or from organic disease of that organ; or it may arise from idiopathic hysteralgia, unaccompanied with any appreciable disease of the uterus.

In these cases, much benefit may be derived from diffusable stimulants, or antispasmodic remedies, such as valerian, galbanum, assafœtida, opium, &c. Sir B. Brodie has found pills of sulphate of copper very useful, when persevered in for a sufficient time. Dr. Addison recommends the injection of astringent lotions into the vagina.

Where there is painful menstruation, or symptoms of congestion of the womb, I know no treatment so effectual as the application of a few leeches to the groin or sacrum. I have seen many cases where immediate relief was obtained in this manner, even where the symptoms closely resembled those of visceral inflammation. Other remedies may also be employed at the same time.

CASES.

CASE I.

Sarah Willis, aged fifty-six, 28th July, 1836.—On Friday morning, the 22d instant, she was suddenly seized with acute pain in the epigastric and umbilical regions, attended with diarrhœa and frequent vomiting.

These symptoms were removed immediately after swallowing the second dose of a mixture which she procured from a druggist; but at the same moment, her voice left her, and she has not since been able to speak, except in a whisper. There is no pain or tenderness over the trachea or larynx. Pulse 100, soft; tongue clean and moist; bowels now constipated. A laxative mixture was prescribed on the 30th, when the bowels were acted upon freely, and the voice instantly returned.

CASE II.

Lucy Payne, aged twenty-nine, May, 1836.—Complains of an unpleasant tingling sensation, which commences at the corners of the mouth, and runs over the upper lip, meeting in the centre. It then divides into two streams, which pass along each side of the nose, again uniting at the pons nasalis.

These attacks are irregular, and are not attended by much suffering, but she experiences, several times a day, sudden shocks of pain, which shoot through different parts of the body, and especially through the arms.

She has sometimes a sensation in the left cheek, as if the jaws were forcibly closed, although she can always separate them without difficulty. When this symptom disappears, it is often succeeded

by the spectral appearance of an eye, which she describes to be of a beautiful blue colour, surrounded by a bright margin of white. It seems to be at a distance of two or three yards, and about a foot below the level of her own eye. It never remains longer than a few minutes, and always vanishes suddenly. Latterly, she has been much troubled by a noise, resembling the fluttering of a bird, close to her left ear. The delusion is so complete, that she sometimes instinctively turns to examine the supposed cause of sensation.

Her general health is good, although the countenance is pale, and her spirits are much dejected. She was confined about three months ago, and is now suckling her child, having abundance of healthy milk.

A quinine mixture was prescribed, which she persevered in taking for some time, but with no benefit.

The strychnine aggravated all the symptoms, and also excited much nervous irritation. She was greatly relieved by a combination of cascarilla and soda, with a slight purgative, which she took for several months.

CASE III.

Emma Sherwyn, aged eleven, 10th August 1837.—About six weeks ago began to suffer from severe headache, and wandering pains of the chest and abdomen. Shortly afterwards, she was attacked with paroxysms of chorea, in which the spasmodic actions were so severe, that it became necessary to employ restraint, in order to prevent her being thrown with violence against the boards which surrounded her bed. The head was a little relieved by blisters and leeches, but no impression had been made upon the convulsive motions by that or any other means. About the beginning of July, they left her suddenly, and she began to utter a monotonous kind of yelling, so loud, that the police insisted upon entering the house to learn the cause of disturbance.

She went on in this manner for about a fortnight, sometimes being attacked with the chorea; at others, making these involuntary cries; afterwards, she began to be much anoyed by the spectral figure of a black cat, which appeared sitting upon the dresser, on the opposite side of the room, staring her in the face for several hours together.

This figure did not vanish suddenly, but when it was about to disappear, its outline became gradually fainter, until it was no longer distinguishable. After a few days, this symptom left her, but she was now seized with acute pain of the left arm, which commenced at the elbow, and extended over the radius, almost to the wrist. From the commencement of her illness there has always been great difficulty in procuring the action of the bowels, notwithstanding that strong purgatives were employed for that purpose.

The stools are black and offensive; the appetite voracious; the intellect clear, and even unusually vivid.

June, 1838.—These symptoms continued to recur at irregular periods, for several months, during which time every remedy which could be suggested was tried without effect: the treatment was afterwards chiefly confined to the employment of purgatives, and she gradually recovered.

The mother of this child and an elder sister began to menstruate in their eleventh year. The breasts are, in the present instance, rather developed, but no other sign of puberty is present.

CASE IV.

Mrs. Lowrie, aged sixty; 18th February, 1834.—For several years, particularly at the commencement of the spring, she has been subject to an annoying pruritus of the left leg, sometimes attended with tingling sensations and slight shooting pain. The attacks are generally preceded by a feeling of cold in the affected limb; there are no external marks of disease; she has taken purgative medicine, and used many local remedies, without relief. The itching was considerably subdued by a few doses of the subcarbonate of iron.

CASE V.

Phœbe Wilson, aged thirty-six; Feb. 24th, 1834.—Experiences a sensation as if a stream of cold air was directed over the left fore-arm and hand. She has several of these attacks in the course of the day, but they do not observe any regular interval, and are unaccompanied by pain. Tenderness, however, over the lower cervical vertebra is perceptible.

Appl. emplast. lyttæ. spinæ. Mistura laxans.

March 2d.—Less spinal tenderness. Cold sensations still felt.

Applicentur cucur. cruent spinæ. Rep. mistura.

10th.—The paroxysms have left her; there is a slight degree of rigidity in the muscles of the left arm, preventing her grasping any thing firmly.

Rep. Mist.

17th.—The power of the arm is completely restored. No return of the cold sensation.

CASE VI.

John Cummins, aged thirty-three, formerly night patrol; 3d June, 1836. Is subject to frequent paroxysms of pain, which commence over the left superciliary ridge, and dart across the forehead; sometimes they pass through the eyes, occasioning momentary blindness, and a copious flow of tears.

When the paroxysm is at its height, the pain frequently passes in an instant from the head to the epigastrium, where it continues for several minutes, and terminates with the secretion of a thin incipid fluid from the stomach.

After walking until he is fatigued, the pain commonly removes to the loins, and darts down the thigh to the knee and foot. It attacks the arms also, when he makes any unusual exertion with them.

His spirits are dejected; tongue clean; appetite good; bowels regular; pulse ninety, weak; no spinal tenderness.

His symptoms began about three years ago, when he was seized with pain in the lower jaw; afterwards, it passed successively to the hollow of the cheek, the external ear, the vertex, and the parts which it occupies at present.

Many remedies were given to this patient without permanent advantage. The pains were for a time mitigated by cupping between the shoulders; they were much aggravated by the carbonate of iron, after each dose of which the head was attacked with renewed violence. Almost complete relief was obtained for some days by his taking the extract of nux vomica, but the benefit derived from this drug also proved transient. Upon one occasion, when he was trying it, a pain attacked the left testicle, where it was beyond comparison greater than any he had previously experienced; it appeared to dart through the centre of the testicle, but ceased in a few moments, and did not recur during the time he was under my care, which was several weeks.

CASE VII.

Ann Dillon, a cook, aged forty; admitted June 24th, 1836.—Three months ago, she punctured with a sharp pointed knife the muscular portion of the right thumb, over the abductor pollicis. The wound bled profusely, and occasioned great pain, but healed rapidly. For several days after the accident, the pain was confined to the wounded spot; but it afterwards attacked the wrist, and from this point darted along the thumb, the indicator, and middle fingers.

At present there is no pain over the seat of the original injury, but when the cicatrix is pressed, an aggravation of the above symptoms ensues. There is considerable tenderness over the lower cervical and upper dorsal vertebræ.

Capiat ferri subcarb. ʒ i, ter die, et pil aperient ii. o. n. The hand to be supported.

June 27th.—The pains now fly up the arm to the axilla, and to the right mamma, covering a space on the external side of the nipple, about the size of a crown piece. Several of these paroxysms occur in the course of a day, during which, the skin over the affected portion of the breast is streaked with red lines.

Capiat nucis vomicæ extract: alcohol: gr. ½, ter die. Mist. laxans.

July 8th.—For the last two nights, the pain was most intolerable, entirely preventing sleep. It continued with the greatest intensity until this morning, when the catamenia appeared, and nearly at the same moment the pain of the breast and arm completely subsided. It is now again confined to the wrist and fingers, and even there is less severe; the spinal tenderness has disappeared.

July 16th.—The pain is gradually subsiding.

The following is the subsequent history of this case:—At the next return of the catamenia, a relapse took place; the pain shot up the arm, and attacked the mamma, and the spinal tenderness reappeared; both of which symptoms immediately vanished when the secretion was established. The same phenomena occurred in the two successive months, except that the sufferings were of a mitigated character.

In the mean while, the original pain of the wrist and fingers subsided; and pressure of the cicatrix could be made without much uneasiness. The patient was enabled to resume her occupations.

CASE VIII.

William Clerk, aged forty; 18th March, 1837.—Suffers acute lancinating pains over a space about the size of half-a-crown on each side of the occiput. The paroxysms are irregular and very frequent.

His complaint began last Christmas, after he had been exposed for several hours to a heavy snow storm; when he was retiring to bed on the same evening, he found the hair over the back of the head completely wet from the melting of the snow, and the occiput felt benumbed. On the following morning he awoke with his present symptoms, which have gradually become more severe.

He has taken, under my direction, quinine, carbonate of iron, strychnine, belladonna, and stramonium, but no relief has been obtained.

The head to be shaved over the occiput, and a blister applied over the seat of the pain on the right side of the head.

19th.—The blister rose well; he thinks the pain rather increased to-day.

The cuticle having been removed, about ¾ of a grain of the strychnine was sprinkled over the abraded surface.

Pulv. Cathart.

20th.—Had a better night; the pain is a little relieved this morning. Repeat the strychnine as before.

21st.—He has had no pain over the blistered surface since yesterday; the complaint has not abated on the left side of the occiput.

A blister to be applied to the left side of the head, and dressed with strychnine. Rep. pulv.

28th.—The head is almost entirely free from pain on both sides; sleeps well; complains of debility; both the blisters have healed.

Mixt. quinin. sulphat. Rep. pulv.

April 3d.—Feels altogether much better; no return of pain. Discharged at the end of the month, cured.

CASE IX.

Elizabeth Hawker, aged fifteen; 17th November, 1836.—About ten or twelve times a day, she is seized with a paroxysm of excruciating pain, which begins at the sides of the neck, about three inches above the clavicle, and shoots along the course of the vessels to the posterior part of the ears and sides of the head. It is felt in precisely the same situations on both sides, but it is much more severe on the left.

The attacks are sudden, having no precursory symptoms. Their duration varies from a few minutes to a quarter of an hour. They frequently occur in the night, rousing her from sleep, and compelling her to cry out violently. The intermissions of pain are complete; there is no tenderness over any portion of the spine, or over the wounded part of the scalp; the countenance is pale and anxious; pulse and tongue natural; bowels regular; the catamenia have not yet been established.

About six months ago, she fell against a grate, and received a blow on the right temple. For two months after this accident, she was occasionally attacked with pain resembling her present symptoms, but of a much milder character. From that time, until within the last six weeks, she has been quite well. Blisters and leeches gave no relief.

Capiat. pil c. extract stramonii. gr. ¼ tertia quaqué hora. Mist. laxans.

18th.—A few minutes after swallowing the second pill, the pain flew from the head to the shoulder, in which part the paroxysms continued to recur during the night. She has had several hours' sleep this morning; the pain is now felt alternately in the shoulder and occiput.

Rep. pil. extract stramonii. gr. ½ quater die. Mist. laxans.

19th.—Slept well; the paroxysms are confined to the side of the head.

20th.—The attacks have distressed her all night, recurring nearly every ten minutes; pupils dilated; dryness of throat.

Omitt. pil. stramonii. Pulv. ferri subcarb. 3 ij. ter die. Rep. mistura.

21st.—Only one paroxysm since yesterday.

Rep.

22d.—No attack. She frequently experienced numbness in the parts which were formerly the seat of pain.

Rep.

29th.—Feels quite well. Discharged cured.

June 25th, 1838.—This patient has had several neuralgic attacks since the date of last report, in which the pain was chiefly confined to the scalp over the right parietal bone, and was excited when pressure was made over the seat of the accident; indeed this spot was at times so tender, that the contact of the lightest substance caused much suffering, which once terminated in an epileptic paroxysm.

The pains were for some time checked by the subcarbonate of iron, but in the more recent attacks this remedy seemed to have lost its power over them. Relief was twice obtained by covering the old cicatrix with lunar caustic. She has now been entirely free from pain for six months, at which time the catamenia became regularly established. The cicatrix, as well as the whole of the scalp, may now be examined and pressed without occasioning any pain.

CASE X.

Charles Wormald, aged fifty-seven, porter; December 4, 1834.—About three weeks ago, in consequence of some accident, a heavy weight was suspended from his left arm for several minutes. When he was released, he felt severe pain in the shoulder, which soon afterwards began to dart through the inside of the arm to the fingers, and, nearly at the same time, through the course of the sciatic nerve.

The hand cannot be raised to the head, partly on account of the sufferings which this motion occasions; but there is also an evident diminution of power in the muscles themselves. He is very lame. the biceps cubitus muscle sometimes contracts spasmodically. The tongue is white; appetite good; pulse natural.

Applicentur cucurb. crnentæ spinæ. Pil. hyd. submur: co. gr. v. bis die. Mist. laxans.

7th.—Less pain of shoulders; bowels constipated.

Rep. pil. Pulv. cathart.

11th.—No improvement.

Capiat nucis vomicæ extract: alcohol. gr. ½ ter die. Rep pulv.

18th.—The pain is less severe, and he can now raise his arm with tolerable ease.

Rep.

29th.—He continued to take his medicine until to-day; he now feels well. Discharged cured.

CASE XI.

Mary Ann Kennedy, aged eleven; Nov. 1837.—Several times a day she is attacked with the following symptoms:—an obscure aching pain occurs along the edge of the inner false ribs, which rapidly grows more acute, and at length darts to the epigastrium,

covering a space not broader than the finger; after a few minutes the paroxysm subsides, and she is completely free from pain.

Her complaint is attributed to a blow over the chest, received about twelve months ago. A paroxysm resembling those from which she now suffers, appeared on the evening of the accident, and attacked her several times each day, for nearly a month afterwards. About three months ago, the sufferings were renewed without any evident cause. The general health is good; tenderness exists over the middle dorsal vertebræ, pressure upon which excites the epigastric pains.

Appl. emplast. canthar. parti dolent. spinæ. Mistura laxans.

12th.—The paroxysms are somewhat less violent.

Rep.

30th.—She has had no pain for several days, until yesterday, when the paroxysms reappeared.

Rep. emplast. lyttæ spinæ. Rep. mist. laxans.

Dec. 5th.—Much relieved; no spinal tenderness perceptible.

Rep. mist. ferri subcarb. gr. xv. ter die.

Jan. 3d, 1838.—No pain for the last fortnight. Discharged cured.

CASE XII.

Sarah Johnson, aged fourteen; 21st Nov. 1836.—Has been subject to acute lancinating pain for several months, which darts across both hypochondria, towards the navel. The paroxysms occur several times a day. There is great tenderness over the dorsal vertebræ, on a level with the seat of the pain; and also over the lower lumbar vertebræ.

She has never menstruated, but has occasionally had a watery discharge from the vagina.

App. emplast: lyttæ lumbis. Pil. aperient. ij. o. n.

24th.—The blister rose well, and the abdominal pains have not since returned.

28th.—No return of pain. The spinal tenderness has also disappeared.

5th Dec.—Discharged cured.

CASE XIII.

Mary Copeland, aged sixteen; September 24th.—This patient has severe pain over the lower part of the abdomen, increased when pressed upon; for which, she says, a blister and leeches have been applied over the affected part without any relief. Pulse 100; skin cool; tongue moist; bowels confined; the catamenia are scanty and irregular, and always accompanied with severe pain. Excessive tenderness over the lumbar vertebræ.

Appl. Hirud: viij. inguini. Mist. camphor et valerian. Pil. aperient. ij. o. n.

25th.—Leeches bled well; several alvine evacuations. The pains have disappeared. Discharged cured.

CASE XIV.

Sarah Budd, aged thirty-five; 7th August 1836.—For the last seven or eight months she has been subject to acute lancinating pains, which dart from the left mastoid process over the side of the head to the vertex. There is much tenderness on pressure over the second and third cervical vertebræ. She has been cupped on the back of the neck; leeches and blisters have been repeatedly applied to the head, and she has taken a large quantity of medicine from different practitioners, without benefit.

Capiat ferri subcarb. 3 i. ter die. Mist. laxans.

September 6th.—No improvement. A few days ago, she discovered a little hard tumour, not larger than the head of a pin, towards the upper part of the left parietal bone, which was painful when touched. As she refused to have it removed by an operation, it was cauterised, and the wound was kept open with the savine ointment.

9th.—The sore discharges healthy pus, and is less tender; other symptoms as before.

Continue.

12th.—She can now suffer the wound to be handled; the cervical tenderness is also decreased, and the pains of scalp less severe.

App. emplast. lyttæ spinæ. quà dolet. Pil. aperient. ij. o. n.

16th.—Spinal tenderness gone, and the other pains are seldom observed.

October 10th.—She called to say that she has never had the least return of her former symptoms.

CASE XV.

Elizabeth Sanger, aged forty-five, widow; August 20th, 1837.—For the last seven years, she has been subject to palpitation and dyspnœa, which have latterly become much more frequent; the pulsation of the heart can be distinguished over the whole anterior and left posterior regions of the chest. She has a continual aching in the left precordial region, and, occasionally, paroxysms of lancinating pain; one of these generally comes on about eleven o'clock, and another at four in the afternoon. Great tenderness exists over the dorsal vertebræ, pressure upon which induces the thoracic pains. The tongue is clean; the appetite variable; the catamenia regular.

Appl. emplast. bellad. lateri sinistræ thoracis. Pil aperient. ii. o. n. Mist. camphoræ et digitalis.

12th.—The paroxysms of lancinating pain have been less severe; spinal tenderness gone.

Rep.

22d.—Feels much relieved.

CASE XVI.

Charles Gregory, aged forty, watchman; 3d January, 1834.—He is attacked several times a day with pain, which shoots along the inside of both arms, from the elbows to the wrists, and is occasionally felt in the thighs and knees, being accompanied by a thrilling sensation in the affected parts. There is tenderness over the middle dorsal vertebræ; his pulse is jerking, but otherwise natural.

About three weeks ago, he fell from a height of several feet upon his back, and was carried home in a state of insensibility, in which he continued for some hours; he afterwards began to feel numbness of the palms of the hands and fingers, and occasionally of the calves of the legs and feet, causing some awkwardness in walking. As these symptoms subsided, his present complaints gradually came on.

Ft. venæsectio ad ʒ xiv. Mist. laxans. Pil. hyd. subm. comp. gr. v. bis die.

From this time the pain rapidly disappeared.

July 17th.—To-day this patient applied again for relief. He states, that with the exception of a feeling of debility, he had enjoyed good health until last Thursday, when having received a severe blow on the chest in the performance of his duty as a watchman, he was almost immediately after seized with vertigo, which terminated in a fit of epilepsy. He now again complains of the same pains of the limbs as formerly; there is great tenderness over the middle dorsal vertebræ; the tongue is coated with bile, of which he yesterday vomited a large quantity.

Applicat. C. C. parti dolent. spinæ. Pil. Hyd. gr. v. o. n. Mist. laxans.

Aug. 4th.—No fit; numbness of the fingers; much less pain.

Rep.

25th.—Feels pretty well.

October 18th.—He enjoyed tolerably good health until last week, when his old symptoms returned in an aggravated form, without apparent cause. He had suffered much pain of the back, which was greatly relieved by cupping; he now complains of severe headach.

App. emplast. lyttæ. spinæ. Mist. laxans.

23d.—The headach is very distressing; the pulse ninety, very small; the countenance anxious; the bowels regular; he is emaciating rapidly.

30th.—He continued to sink gradually; and for the last five days he had not been able to pass his urine without the catheter.

About twelve o'clock yesterday morning he fell into a comotose state, and died at nine last night.

Sectio cadaveris.—Brain.—Increased vascularity of the dura mater, which adhered firmly to the arachnoid, about the middle of the left hemisphere, at the margin of the sulcus, dividing the two hemispheres. A small quantity of lymph and osseous matter were found on this spot. The arachnoid had a cloudy appearance, and seemed thickened. The pia-mater was much injected. The substance of the brain was firm, except a portion of the right thalamus, which was reduced to a pulp. About two ounces of bloody serum were contained in the ventricles. The theca of the spinal marrow adhered firmly to the spinal canal, at the fourth dorsal vertebra. Considerable serous effusion under the theca. The nerves passing from the spinal marrow to the third and fourth dorsal vertebræ, are extremely vascular. About the seventh dorsal vertebra, the medullary matter was reduced almost to a liquid state, for rather more than an inch. There was nothing remarkable in the other viscera.

CASE XVII.

Thomas Rushen, aged forty, watchman; 19th April, 1834.—About a month ago, he was attacked with an extremely acute lancinating pain in the left wrist, which after remaining in that situation a few hours, suddenly changed to the left elbow, and subsequently to the right knee. The pain has returned at irregular intervals, to one or other of the above situations; but during the last two or three days, the attacks have been confined to the knee. Pulse and tongue natural; no heat or swelling of the affected joints, which can be moved freely, without materially increasing the pain; but he says that the paroxysms are excited by walking.

Mist. cinchonæ c. tinct: guiac. ammon. Pil. aperient. ij. o. n.

21st.—Several paroxysms occurred yesterday, the pain being confined to the right knee.

Capiat nucis vomicæ. extract. gr. ¼ ter die. Rep. pil. aper.

May 10th.—The pain commenced yesterday morning in the knee, but after a few minutes suddenly changed to the left elbow. It was of a milder character than usual, and the paroxysms continued a shorter period.

Rep. extract: nucis vom. gr. ½ ter die. et pil. aperient.

12th.—Continuing to improve.

Rep.

20th.—Is nearly free from pain. Discharged cured.

CASE XVIII.

Mary Legge, aged sixty-three; June, 1838.—For the last twelve years she has suffered from attacks of facial neuralgia in its most aggravated form. The pains occupied the angle of the jaw on the left side, the hollow of the cheek, the temple, and the gum.

Since the commencement of her complaint, the pain has sometimes been completely suspended for three or four months, and has again returned without any perceptible cause.

About two years ago, after having enjoyed a long respite from the attack, it was renewed with great violence. Every remedy that could be suggested was tried, without avail, by myself and other practitioners, when the pain suddenly flew from the face to the left arm, near the insertion of the deltoid muscle. It continued there in paroxysms for several days, and then returned to its former situation.

An issue having been made in the arm, the attacks were again drawn from the face; and so great was the relief, that although the pain of the arm was considerable, she almost disregarded it, through the comparison she made with her late sufferings.

The issue has now been open fifteen months, since which the facial neuralgia has been nearly suspended; it has, however, returned occasionally, for a few days, but a little purgative medicine is now usually sufficient to subdue it; or, when this fails, the application of stimulating ointment to the issue has always proved successful. The pain of the arm returns frequently, but it has not been latterly of violent character.

She attributes the commencement of her sufferings to sitting, during several years, for many hours each day, in the open window of a ham-shop, where the left side of the face was exposed to the cold air; she had, however, quitted her place before any symptom of the neuralgic affection appeared.

CASE XIX.

Edward Hayman, aged forty, tailor; March 15th, 1837.—Was attacked yesterday morning with severe shooting pains over the left temple, which continued for several hours, leaving a dull pain over the affected part. A similar paroxysm occurred about seven o'clock last night, which lasted until twelve, and then subsided. He slept well; the tongue is clean; the appetite good; the bowels regular.

Extract. bellad. gr. ½ tertiâ quâque hora. Mist. laxans.

16th.—A severe paroxysm this morning at nine o'clock, which continued until one.

Rep. pil. et mistura.

17th.—Vertigo came on yesterday, consequently the pills were discontinued. He had a severe paroxysm of pain to-day, at seven o'clock. The blister rose well; and the cuticle having been removed, about ½ grain of strychnine was sprinkled over the surface.

18th.—No return of pain yesterday; but this morning about seven o'clock he had a paroxysm, which was much less severe than formerly.

Two thirds of a grain of the strychnine was applied to the blistered surface. Mist. laxans.

19th.—Rather acute pain for about half an hour after the application of the strychnine, but none since. The blistered surface is dried up.

Rep. mistura.

23d.—Scarcely any pain since last report. Discharged cured.

CASE XX.

Samuel Deshon, aged twenty-eight, pocket-book-maker; 28th July 1838.—Has suffered for the last seven weeks from paroxysms of acute lancinating pain, which commence over the deltoid muscles, shoot down both arms, terminating on the right side (where it is most severe) in the middle finger; and on the left, in the middle and ring fingers. Before the occurrence of these symptoms, he had been affected for several days with shooting pains in the right side of the head; but they left him suddenly and flew to their present situation. The attacks come on at eight o'clock every night, and continue until four in the morning, entirely preventing sleep during that time.

Scarcely any mitigation of his sufferings having been procured by any mode of treatment, a quantity of morphine, not exceeding the sixteenth part of a grain, previously moistened with a little water so as to form a paste, was inserted under the cuticle over the right deltoid muscle. Four punctures were made, about the distance of an inch from each other. In a few seconds, a white tubercle, nearly circular, was distinctly visible in the situation of each puncture, gradually increasing in size, until it resembled the mark occasioned by a bug-bite. Each of these tubercles was surrounded by an areola, the margins of which subsequently communicated, so as to give the arm an erythematous appearance; at the same time, tingling and pricking sensations were felt over the spot, which continued for about two hours, when every trace of the action of the morphine disappeared.

Although this process was employed during the intermission, the pain did not return in the right arm that night; it was still felt in the left arm, but did not prevent the patient from sleeping the whole night, for the first time during several weeks. On the following morning, the same treatment was applied to the left arm, and with a similar result, and the symptoms permanently disappeared. No general narcotic effect was occasioned by the morphine.

OBSERVATIONS

ON THE

CONDITION OF THE INSANE POOR.[1]

[The following facts and arguments are extracted from "An Appeal to the People of Pennsylvania on the subject of an Asylum for the Insane Poor of the Commonwealth." The appeal was prepared by a committee, of which the editor of the "Library" was chairman; the laudable object of the association by which the committee was appointed, being to take into consideration the propriety of adopting measures to establish, at public expense, an asylum for the insane poor of Pennsylvania. The editor's colleagues on the committee were Fred. A. Packard, Esq. and Caspar Morris, M. D.]

The condition of the insane poor in this commonwealth has for some time been a topic of absorbing interest with the philanthropist. Of the different forms of misfortune and misery, insanity excites the most painful emotions. The horror which it occasions in the minds of most persons; the utter helplessness of the afflicted; and the degradation and cruelty to which they are too often subjected, render them peculiarly the objects of benevolent solicitude.

* * * * * * *

It has been a matter of statistical investigation in many countries of Europe, and in various states of this Union, to discover the ratio of insane, and especially of insane poor, to the rest of the population. Unfortunately, the estimates on this subject have not been made in such a manner as to command implicit reliance, with the exception perhaps of those of Norway. In the year 1825, the Storling directed that a special enquiry on this subject should be instituted, the results of which have been published by Dr. Holtz. In 1829, Sir Andrew Halliday furnished a tolerably accurate estimate of the number in England and Scotland; and Dr. Brièe de Boismont, well known for his researches in regard to the insane, has given the number in twenty-one establishments in the principal cities of Italy, which he visited in the year 1830.

The estimates of different observers have been collected by Esquirol, and others: from these it would appear, that in England, the proportion of insane to the whole population is 1 in 783; in Wales, 1 in 911; in Scotland, 1 in 573; in the Rhenish provinces,

[1] An Appeal to the People of Pennsylvania on the subject of an Asylum for the Insane Poor of the Commonwealth. 8vo. pp. 24. Philadelphia, 1839.

1 in 1000; in Norway, 1 in 551; in France, 1 in 1750; and in Italy, 1 in 3785; the limits, consequently, between the number of the insane compared with the population being, in Europe, between 1 in 550, and 1 in 3785; a wide and singular difference, and one by no means easy of explanation. Esquirol suggests, that owing to Norway and Scotland being mountainous countries, idiots are more numerous than in those which are more level; idiocy or mental *imbecility*, he conceives, being owing to physical circumstances connected with locality, whilst madness or mental *perversion* is the product of society and of intellectual and moral influences; in idiocy causes have interfered with the development of the organs, whilst in madness the over-excited brain has transcended its healthy boundaries. But although locality has, doubtless, its influence in the production of certain forms of insanity, as of other diseased conditions, it is impossible to regard the rule absolute when we refer to the enumerations of Europe or of this country,—the proportion in Wales, which is extensively mountainous, being small, and that of Italy, traversed by lofty ridges, the least in the tables.

In this country, the proportion of the insane to the rest of the population has been largely overrated.

From extremely inadequate data, it was affirmed by an able writer, a few years ago, that the ratio in the United States was as high as 1 in 262; and this affirmation was made in the face of the enumeration of the State of New York, in 1825, which has been adopted by Esquirol and other writers on the statistics of insanity, and which showed, that there was in that state 1 insane person to every 721. As the State of New York contains nearly one-sixth part of the population of the Union, any accurate enumeration afforded by it merits every attention. In the year 1825, the proportion of the insane there to the whole population was 1 to 1974 nearly; of idiots, 1 to 1138 nearly; and of both classes, 1 to 721 and a fraction. In 1835, on a fresh enumeration, the proportion of insane was 1 to 2249 nearly; of idiots 1 to 1465 and a fraction; and of both classes 1 to 887 and a fraction, thus exhibiting a diminution in the ratio in the last ten years—under the presumption that the enumerations were equally accurate—in the ratio of 887 to 721, and showing, that in New York at least there has not been that increase in the number of the insane, which has been considered to have taken place to an alarming extent elsewhere.

Estimates have been made as to the number of the insane in some of the New England states, but although those states have been amongst the foremost in ameliorating the condition of these unfortunates, there does not appear to have been sufficient extent of statistical details; the general estimates being commonly deduced from partial enumerations, from which it has been attempted to infer the proportion in the whole state.

As respects the precise ratio in the commonwealth of Pennsylvania, we have no enumerations on which reliance can be placed;

but evidence enough exists to show that it is considerable. In the single almshouse of the city of Philadelphia there are in the lunatic department at this time 174 patients—90 males and 84 females; and in other parts of the establishment 50 or 60, who are more or less fatuous; and as these are chiefly from the county of Philadelphia, we may presume that the proportion in the whole state is at least as great as in the neighbouring State of New York; that is, as we have shown, 1 in 887 and a fraction, making about 1800 insane persons in Pennsylvania; but presuming that it is not higher than 1 in 1000, there must be in the state, of all clases, at least 1600 insane. If, then, we take again the State of New York as a guide,—in which the proportion of idiots in 1835, was as 1484 to 967, or three-fifths of the whole number,—the number of lunatics in Pennsylvania may be estimated at 600 or 700, and of idiots at 1000 or 1100,—and this is probably a low estimate.

Granting, then, that there are from 1600 to 1800 insane persons in this state, it is an interesting enquiry to determine what proportion of these are supported by their friends,—at home, or in some of the excellent establishments which exist among us; how many are in a state of destitution, and what number are already receiving that assistance which the almshouses are capable of affording.

Now, the results of all enquiries on this matter have shown, that persons in easy circumstances are far less subject to insanity than those who are indigent, and too often intemperate.

The ratio of the insane amongst the indigent classes, as given by Sir Andrew Halliday, is indeed surprising: of 14000 insane persons in England and Wales, 11000 are supposed by him to be indigent. In the census of the state of New York, taken in 1835, it is stated, that of 967 lunatics, (that is, exclusive of idiots) 382 were supported by charity, and 312 were able to support themselves—leaving 273 not classified, but who, it is affirmed, were, doubtless, in indigent circumstances. This is proved, indeed, by the abstracts of the returns of the superintendents of the poor of the state of New York, from which it appears that 652 lunatics were relieved, or supported during the year ending the 1st December, 1837. This number added to 312, the number reported in 1835 as of sufficient pecuniary ability to support themselves, gives an aggregate of 964,—only three less than the whole number of lunatics in the state in 1835.

From the same documents we learn, that of the 1484 idiots, the whole number in the state in 1835, 514 were supported by charity, and 549 were possessed—directly or indirectly—of sufficient pecuniary ability to support themselves, leaving 421 not classified.

It would seem, however, that during the year ending the 31st of December, 1837, not more than 249 idiots were supported or relieved by the superintendents of the poor; which is ascribed, by the secretary of state of that commonwealth, to their being generally harmless, with little or no hope existing in the minds of their friends of restoration; and therefore they are supported at home by their families, aided by the private charity of neighbours;—an inference

which is confirmed by the facts relating to the deaf-dumb, less than two fifths of whom, in unquestionable indigence, are supported or assisted by the public authorities; the remaining three fifths being provided—and too frequently wretchedly provided—for at home, partly by their relatives, and partly by private charity.

In other states of the Union, attempts have equally been made to determine the number of insane who are supported by public or private bounty. Of these—as probably the most accurate and comprehensive—we may adduce the results laid before the general assembly of Connecticut in May last, by a committee appointed by the assembly to ascertain the number, age, sex, and condition of the lunatics of that state; also to ascertain the best and most effectual means of relief, the amount of money necessary to be expended for the establishment of an appropriate institution, and other relevant matters.

The enquiries of this committee, by whom an able report was drawn up and presented, were confined to the number of the destitute, who were either supported by the towns or by charity; and from their summary it appears, that in 118 towns of that commonwealth there were 129 males and 192 females entirely supported by the towns; 86 males and 59 females partly supported, or receiving assistance from the towns, and 100 males and 141 females supported by charity;—in all, 707 insane and idiotic were returned, of whom 59 were in confinement.

It is probable—although we have no exact statistical information—that the number in the towns of Pennsylvania, of equal population, is less than in those of Connecticut; but we have no reason to believe that it can vary much from those of New York.

Recurring to this, then, as our foundation, we may infer that of the 600 or 700 lunatics—the presumed number in Pennsylvania, exclusive of idiots—from 400 to 500 might require the assistance which the contemplated charity is capable of affording.

The evils that result from the want of such an establishment are comprehended in their full extent by those only whose opportunities, inclinations, or duties, have led them into a close investigation of the subject.

Although the period has passed away when the insane were thought to be possessed of demons, and therefore to be shunned and despised, the notion is still too prevalent, that but little advantage is to accrue from the most skilful medical management; and, consequently, that the establishment of any extensive institution for their restoration is an unnecessary tax; and that nothing farther is needed than to protect the community from the attacks of the furious and the malevolent. This erroneous view has been the source of much mischief, and has led to the practice adopted in many countries—indeed to a certain extent over the whole of this and other states—of committing the refractory lunatic to the common jails or penitentiaries, where he may be safely kept from injury to others, but where he can of course receive neither appropriate

medical nor moral treatment. When, indeed, a prisoner is pronounced insane in our higher courts of justice, he is doomed to the cell of the convict, to pass there the remainder of his wretched existence, punished for offences of which he must be esteemed innocent; and immured for a mental infliction which might often certainly be removed under judicious management in a proper asylum. Yet, in the absence of such an asylum, this course is inevitable; and it is the source of much solicitude to every judge possessed of the kindlier sensibilities.

In the earlier ages, when sound philosophy was but little cultivated, and every infliction of the kind we are considering was regarded—as it must be—one of the most awful of the dispensations of the Almighty, it is not surprising that it should have been believed to set at defiance all attempts at explanation, and the best directed efforts for its removal. Modern science and philanthropy have, however, afforded the most signal evidence of the inaccuracy of the ideas of our ancestors in relation to the curability of this disease,—for disease it doubtless is,—and one essentially physical in its character, although after it has continued for a certain time not capable of being materially influenced by ordinary physical remedies.

When the late Dr. Willis—well known as the physician to whose immediate care the then king of England, George the Third, was entrusted during his first attack of insanity—stated, in his evidence before a committee of the British parliament, that 9 out of 10 cases of insanity recovered, when they were placed under his care within three months from the first attack, his assertion was discredited by both the unprofessional and the professional; yet its accuracy has been since amply established. Dr. Burrows, of London, in one of his works on insanity, reports the ratio of cures, in his experience, to have been 81 in the 100, taking the aggregate of all cases; 91 in the 100 in recent cases, and 35 in the 100 in old cases. Sir W. C. Ellis affirms, that of 312 patients, admitted into the York West Riding Lunatic Asylum within three months of the attack, 216 recovered;—a somewhat smaller proportion than in the cases above mentioned, yet in the highest degree satisfactory.

Nor has the experience of our own country been less encouraging. In the asylum for poor lunatics at Worcester, Massachusetts, —of the patients admitted during the year ending Nov. 30th, 1835, whose insanity was of less than twelve months' duration, the recoveries were 82½ per cent. Of the old cases, for the same time, only 15½ per cent. In the M'Lean asylum at Charleston, in the same state, the ratio of recoveries in recent cases—that is, of those not over one year's standing—was in 1837, 864 per cent.; of old cases, 38 per cent.; and of all about 71 per cent.

It is essential to bear in mind this immense difference in the curability of insanity in recent and in chronic cases,—9 out of 10, it will have been observed, when the disease has existed under three months; and 8½ in 10 when it has existed under twelve months:

whilst, in chronic cases, not more than 4 in 10—if we take the highest estimate, that of the M'Lean Asylum, which, being founded on one year's observation only, can scarcely perhaps be esteemed decisive, especially when we mark the great difference between it and the results in other insane establishments. Sir W. C. Ellis states, that at the York West Riding Asylum, of 318 cases, that had existed from one to thirty years, only 26 were cured. Of 173 old cases, in the Bloomingdale Asylum, New York, in 1835, only 16 were restored,—and M. Esquirol, in a memoir published in 1816, and recently reprinted, and consequently confirmed by him, has asserted that after the disease has passed the third year of duration, the probability of cure is scarcely more than 1 in 30.

Can any thing exhibit more forcibly the necessity of *early* recourse to appropriate treatment?

We are told by the same enlightened and practised observer, that there were admitted into La Salpetrière—the extensive public insane institution at Paris—during the ten years from 1804 to 1813 inclusive, 2800 insane females; of these, 795 were found to be incurable, either from age, idiocy, epilepsy, or palsy; and 2005 were placed under treatment, without any regard being paid to the duration or character of the mental alienation. Of this number, 604 were cured during the first year, 500 during the second, 96 in the third, and 41 in the seven following years; from which M. Esquirol concludes :—1st, That the greatest number of cures is effected in the first two years; 2dly, That the mean term of cure is a little less than a year; and 3dly, That after the third year, as has been before remarked, the probability of cure is scarcely more than 1 in 30.

Contrast, now, M. Esquirol's second deduction, that the average term of cure is a little less than a year—and Pinel, his distinguished predecessor, estimates it at much less, between five and six months —with the published results obtained by a committee of the legislature of New Hampshire appointed to ascertain the condition of the insane in that state, in which there is no lunatic asylum. They report, that the average duration of the disease in their insane is between *thirteen and fourteen years!*

Yet, although the ratio of cures diminishes so largely as the disease is more protracted, no case ought to be adjudged desperate: many are the instances on record, and still more which have not been recorded, of persons who have been esteemed incurably maniacal or melancholic, and who have, notwithstanding, been restored to the full possession of their intelligence. Pinel gives the memorable case of a lady, who had passed twenty-five years in a state of mania, and who suddenly recovered her reason; and Esquirol that of a young girl, who had been for ten years in a state of incoherence, and who, one morning on rising, ran and embraced her mother, calling out, "O! mamma, I am cured." He states, also, that whilst he was at La Salpetrière, a woman who had been insane

from the period of puberty, was suddenly restored at the age of forty-two.

But it is now universally conceded, that in order for full advantage to be derived from medical and moral management, the insane should be removed from every object that may excite there hallucinations, to situations were all means and appliances exist to prevent the insane idea from obtruding itself; where they can have the advantage of the best medical aid, and of that moral revulsion, which air, exercise, and appropriate labour or amusement, are alone capable of affording.

Now, when we look at the condition of the insane paupers in this commonwealth, we find that no such provision exists for them; but that they may be divided into three classes; the first, comprising those who are retained at home; the second, those who are in the almshouses; and the third, those who are in the prisons or penitentiaries.

As regards the *first class*, it requires but slight reflection to determine, that their condition must be wretched in the extreme, and the prospect of cure almost null. It is every where admitted, that the chance of restoration is but slight, even amongst the wealthy insane, provided they are kept amongst the objects and scenes that are connected with their delusions. Generally, too, one of the first evidences of insanity is a dislike to those who were previously most dear to them, which is apt, indeed, to persist as long as the aberration continues. It is obviously, therefore, of moment to remove them from those sources of irritation to institutions in which they are soon taught to brook control, and in which every attention is paid to their comfort and restoration.

But if this applies to insane persons who are well to do in the world, how much more forcibly must it be applicable to such as are in the humbler spheres of life, and too often in the depths of destitution; doomed necessarily to neglect, abuse and privation. Their case is, indeed, most hopeless. It is now, we believe, the universal sentiment amongst the informed, that no case of insanity can be as satisfactorily treated in a private house, no matter how well regulated it may be, as in institutions established for the purpose. We well recollect how forcibly this conviction was impressed upon our mind by the *fatal* consequences of inevitable neglect, during the severity of winter, in a case, which was attempted to be treated at home; under the double impression, on the part of the family, that the ordinary servants of the house would be able to attend to the sufferer, and that there was something revolting in sending a relative to a public institution, where neglect was possible, and where he would be deprived of those cares, which relatives—it is too often erroneously conceived—are alone able to bestow.

The *second class*, the insane who are in the county almshouses, are of course in a somewhat better condition than those who are supported at home on public or private bounty; yet their state is in all cases far from what it ought to be, and in many cases deplorable.

There is every reason to believe, that the Philadelphia Almshouse, at Blockley, is a highly favorable specimen of those institutions, and that the medical and moral management of the insane is there on at least as good a footing as in any similar establishment in the state; yet so satisfied are the medical officers of that institution, of the inadequacy of their means of appropriate treatment, that a committee of their body has been appointed to suggest to the board of managers, whether some alteration cannot be effected by which a better classification of the insane may be practicable. As the building is at present arranged, the furious maniac is compelled to be placed in the same range of apartments with him whose reason is but slightly unsettled; and all attempts at proper classification have hitherto been futile. It is to be apprehended, indeed, that with every disposition on the part of the present board of managers to afford all facilities in their power, the arrangement of the building is such as to preclude any well founded hope of satisfactory modification. Could this, indeed, be accomplished, the lunatic would still be in want of those advantages, which a well regulated asylum, with its various establishments for labour and amusement, is capable of affording.

But if the Philadelphia Almshouse be thus defective, how much more objectionable must some of those institutions of a similar character be, which are situate in the interior of the country, remote from that influence, which is alone adequately felt in the vicinity of the larger cities. At the meeting held in Philadelphia, the furtherance of whose charitable objects is the occasion of the present appeal, cases were detailed of mal-treatment and neglect, sufficient to make the heart sick.

The very arrangement of an almshouse renders it, indeed, miserably defective for the purpose of an insane asylum. It rarely or never happens, that there is a resident medical superintendent. Usually, a physician, who is liable to be often changed from political or other motives, visits the establishment two or three times a week, and rarely stays sufficiently long to enable him to enquire into more than the acute cases of disease; the remainder, including the insane in a body, are generally postponed, neglected, or but inadequately attended to.

In the Philadelphia Almshouse, a resident physician—who is either a student, not a graduate, but proved, on examination by the medical board, to be competent for the office, or who has recently graduated—takes the immediate charge of the lunatic department for six weeks; the number of services during the year not permitting him to devote a longer period to any one of them. The attending physicians, who are non-residents, and on whom the charge of the lunatic, along with the other, wards really devolves—the resident physicians being required to act under their direction, are on service six months alternately, and generally pay daily visits; but as they have to attend to all the sick wards in that extensive charity, they cannot devote the necessary attention to the

lunatic department. This, consequently, is an imperfect substitute for a resident medical superintendent, permanently appointed to his office, and who is versed in the care of mental maladies, or capable of becoming so by rigid devotion to their investigation. Every change of the medical adviser gives occasion to exacerbations of the disorder, as the appearance of every stranger is daily seen to excite the maniac to vociferation and violence.

Under such an imperfect organisation of the lunatic departments of the county almshouses, we ought not to be astonished that there should be a comparatively small number of cures in recent cases, and that many, who, under a better system of management might have been restored, become incurably insane.

It has been before observed, that although insanity must be regarded as essentially a physical disease, it is not one which, after it has continued for some time, can generally be cured by such remedies as are known to remove ordinary physical excitement. The period soon arrives when a judicious moral management is the main stay of the physician. This, not one of our county almshouses is capable of affording.

By a proper classification of the insane, it will be found, that there are comparatively few who are incapable of participating in labour or amusement. Every well devised asylum should, therefore, be able to employ such of the patients as are fitted for the task, in agricultural or horticultural labours; workshops should be provided, and employment of some kind or other be carefully adapted to each individual. The attention, which such occupations require, produces a moral revulsion, and prevents the topic of hallucination from recurring; or if it recur, from wholly engrossing the mind of the lunatic. This is now so well understood, that in the different insane establishments of this country it is an object of anxious solicitude on the part of the medical superintendent, and the results have been most salutary.

"From the commencement," say the trustees of the Asylum for the Insane Poor in Vermont, "an excellent farm of about fifty acres was procured as a necessary appendage to the institution. We have been determined to have a fair trial made of employing the patients on the same, and have the effects strictly noticed. Here we add our own to the universal testimony of others on the subject, that useful labour for convalescents and all chronic cases is the best moral means that can be made use of in the treatment of insanity. It is difficult to divert patients from cherishing their hallucinations, unless some interesting employment is furnished for them. The patients thus employed are generally cheerful and happy during the day, and sleep quietly at night. The exercise gives them an appetite for food, and the whole physical system as well as the mind, seems to be thereby invigorated. It recalls to mind their former employments and pursuits, rouses into action those faculties of the mind which had before lain dormant, and gives rest to those which had been unduly excited. As the number

of our male patients has been small, not only the quiet, but also those who were more excited, have been taken on the farm; and, in every case, regular employment has been found very beneficial. No patient has been restricted in the use of tools, either at the wood yard, in the garden, or on the farm, and yet not the slightest accident whatever has happened. The patients consider themselves as enjoying the confidence of the officers, and make every effort that it should not be misplaced."

Sir W. C. Ellis deposes in his recent publication to the same beneficial results, feelingly depicting the obstacles that were thrown in the way of the introduction of manufactories into the admirable institution which he superintends. "Hitherto," he adds, "no accident of any consequence has happened from the patients being entrusted with tools, and no unpleasant result has arisen from the female patients, under proper charge of their nurses, working in the grounds or shops, where male patients, also, under proper care, have been at the same time employed. It is, however, possible that some untoward accident may happen; but even then I should be sorry the system should be given up. The injuries in one or two instances, are nothing in comparison with the constant and daily happiness which it affords to hundreds; and it is not possible, in this world, to have a great good without some danger of evil arising from it. But as, in the ordinary events of life, we do not permit a little inconvenience to stand in the way of our enjoying great happiness; so ought we not, in this case, to be deterred from pursuing our plan, even should some unforeseen calamity, which I pray God to forbid, overtake us."

"In the first instance," he says in another place, "out of door employment is generally tried; the patient is put under the especial charge of one of the servants, and set to work on the ground in such a way as to avoid any danger of his injuring himself or others. By and by, as his character becomes more known, and it is considered safe to trust him, in case of his being a mechanic, he is taken to the keeper, who has the same occupation with which he is acquainted, and is induced to work at his trade. And as there are bricklayers, joiners, tinners, blacksmiths, shoemakers, tailors, brushmakers, twinemakers, pottlemakers, basketmakers, and coopers, all at work about the institution, it is most probable that a mechanic will be able to select from amongst them some occupation with which he has been previously acquainted, or which he might like to learn; at all events, the reward of a little tea, tobacco, beer, or some other luxury, congenial to his taste, will, with a little management, generally be sufficient to induce him to occupy himself, either in his ward, or out of doors. Indeed, on an average, 454 out of the 612 are daily employed: and of the others, who are idle, some are fatuous, others in such a state of debility as to be unable to work, and only very few idle solely from disinclination to employment. The patients rise at six in the morning; at eight they assemble in the chapel for family prayers, and immediately after-

wards they breakfast; at nine they go to their work; at eleven the workers out of doors have an allowance of one third of a pint of beer; at one they dine; at four they have a similar allowance of beer; and at seven they sup."

But we need not go to other countries to discover the effects of well adapted moral management on the insane. The reports, which annually emanate from the excellent officers of the Friends' Asylum near Frankford; the Asylum for the Insane Poor in Vermont; the M'Lean Asylum at Charlestown; the Asylum for Poor Lunatics at Worcester, Massachusetts, and others, sufficiently testify to the interesting fact, that however perverted may be the reasoning powers, there are but few who are unsusceptible of appropriate appeals when judiciously employed. Who, indeed, would have credited—fifty years ago—the testimony afforded us in the reports above referred to, that numbers have attended public worship in the chapels of the institutions, and conducted themselves with the greatest decorum, who in the halls were noisy, talkative and profane!

"Can we contemplate," says Dr. Woodward, the intelligent superintendent of the asylum at Worcester, Massachusetts, "a more interesting spectacle than the assembly of the insane, a large proportion of whom had been incarcerated for years in prisons and in dungeons, or confined with chains and manacles, the objects of terror and dread to all around them, convened on the Sabbath for public worship, all decently clad, and respectable in appearance, calm, and self-possessed, listening with apparent attention to the messages of truth, uniting in the devotions, and joining in the songs of praise, all going and returning from the chapel with order and decorum? Such a spectacle we have witnessed on each returning Sabbath since our chapel was consecrated. Who can longer doubt that Christianity brings its consolations to the insane as well as to the rational mind?"

For these salutary reforms in the moral management of insanity, we are mainly indebted to a learned French physician, who, less than fifty years ago, had the hardihood to oppose the revolting management at that time universally in use in the insane institutions of Paris, and whose boldness, judgment, and philanthropy were crowned with a degree of success which must have been as gratifying as it was astonishing to him.

In a work recently published, and now before us, M. Scipion Pinel, the son of the great reformer, has given the details of the experiment, which, as he properly remarks, is celebrated in the annals of science. In the latter months of the year 1792, Pinel, who had been for some time chief physician to the Bicêtre, begged repeatedly of the public authorities, to permit him to remove the chains from the furious. His applications having been unsuccessful, he presented himself before the commune of Paris, and, repeating his objections with increased warmth, urged a reform of such monstrous treatment.

"Citizen," said one of the members to him, "I will go to-morrow to visit the Bicêtre: but wo betide thee, if thou deceivest us, and if thou concealest any of the enemies of the people amongst thy insane."

This member of the commune was Couthon. The next day he went to the Bicêtre. Couthon was himself, perhaps, as strange a spectacle as any whom he visited. Deprived of the use of his lower extremities, and compelled to be borne on the arms of others, he appeared, says Pinel, a fraction of humanity implanted on another's body; and from out of his deformity, pronounced in a feeble and feminine voice, merciless sentences proceeded—sentences of death; for death was the only logic that then prevailed. Couthon visited the insane in succession and questioned them himself, but he received only imprecations, amidst the clanking of chains on floors disgustingly filthy from the evacuations of the miserable occupants.

Fatigued with the monotony and revolting character of this spectacle, Couthon returned to Pinel. "Citizen," said he to Pinel, "art thou thyself mad to desire to unchain such animals?"

"Citizen," replied Pinel, "I am convinced that these lunatics are only intractable from being deprived of air and liberty, and I expect much from a different course."

"Well," said Couthon, "do as thou likest. I leave them to thee. But I am afraid thou wilt fall a victim to thy presumption."

Master of his own actions, Pinel commenced his undertaking on the very day, fully aware of all its real difficulties; for it regarded the setting at liberty about fifty furious maniacs, without injurious or dangerous consequences resulting to the other peaceable inmates of the establishment. He determined to unchain no more than twelve at the first trial, and the only precaution he took was to have an equal number of strait jackets prepared, made of strong linen with long sleeves, which could be tied behind the back of the maniac, should it become necessary to restrict him from committing acts of violence.

The first person to whom Pinel addressed himself had been a resident for the longest period in this abode of misery. He was an English captain, whose history was unknown, and who had been chained there for forty years. He was looked upon as the most terrible of all the insane; his attendants always approached him with circumspection, for, in a paroxysm of fury, he had struck one of the servants on the head with his manacles, and killed him on the spot. He was confined with more rigour than many of the others, which circumstance, combined with almost total neglect on the part of the keepers, had exasperated a disposition naturally furious.

Pinel entered his cell alone, and approached him calmly. "Captain," said he, "if I were to remove your chains, and to give you liberty to walk in the court, would you promise me to be rational and to do harm to no one?"

"I promise thee. But thou mockest me. They, as well as thyself, are too much afraid of me."

"Assuredly not. I have no fear: for I have six men at hand to make me respected, should it be necessary. But believe my word: be confiding and docile. I will give you liberty, if you will allow me to substitute this strait waistcoat for your ponderous chains."

The captain yielded with a good grace to every thing required of him; shrugging his shoulders, however, but without uttering a word. In a few minutes his irons were completely removed, and Pinel withdrew, leaving the door of the cell open. Several times the maniac raised himself from his seat, but fell again; he had kept the sitting posture so long that he had lost the use of his legs; at length, in about a quarter of an hour, and after repeated attempts, he succeeded in retaining his equilibrium, and from the depth of his dark cell advanced staggering towards the door. His first action was to look at the sky, and to exclaim in ecstasy. "How beautiful!" Through the whole day he ran about, ascending and descending the stairs, and constantly repeating the exclamation, "How beautiful! how good!" In the evening he returned to his cell, slept tranquilly on a better bed, which had been provided for him, and during the two additional years which he passed in the Bicêtre he had no paroxysm of fury. He rendered himself, indeed, useful in the establishment, by exerting a certain degree of authority over the patients, whom he governed after his own fashion, and over whom he elected himself a kind of superintendent.

But the case of Chevingé—a soldier of the French guards—is looked upon as one of the most memorable feats of that interesting and eventful day. Whilst in the service he had but one fault—drunkenness;—and when in this state he became turbulent, violent, and the more dangerous from his strength being prodigious. Owing to his repeated excesses he was dismissed from his regiment, and soon dissipated his limited resources. Shame and misery subsequently plunged him into such a state of depression, that his intellect became disordered. In his delirium he thought he had been made a general; beat those who did not admit his rank and quality, and in consequence of a violent disturbance thus originating, he was taken to the Bicêtre, labouring under the most furious excitement. He had been confined, chained, for ten years, and with more severity than most of his fellow sufferers, as he had frequently broken asunder his irons by the sole strength of his hands. On one occasion, when he obtained momentary liberty in this manner, he set at defiance the united efforts of all his keepers to make him re-enter his cell. His strength had, indeed, become proverbial at the Bicêtre.

Pinel, on several visits, had discovered in Chevingé an excellent disposition, masked by the excitement incessantly occasioned by cruel treatment. He promised the lunatic to speedily ameliorate his condition, and this promise itself rendered him more tranquil. Pinel at length told him he should be no longer chained; "and to prove the confidence I have in thee," said he, "and that I regard

thee as a man adapted for doing good, thou shalt aid me in freeing those unfortunates, who have not their reason like thee; and if thou conductest thyself as I have reason to hope, I will take thee into my service, and thou shalt never quit me."

"Never," says M. Scipion Pinel, "in the whole history of the human intellect, was there a more sudden and complete revolution: the keepers themselves were impressed with respect and astonishment at the spectacle which Chevigné afforded." Scarcely was he liberated, when he was seen anticipating, attentive to, and following with his eye, every motion of Pinel; executing his orders with skill and promptitude, addressing words of reason and kindness to the insane, on the level of whom he had been but a short time previously.

This man, whom chains had kept degraded during the best years of his life, and who would, doubtless, have spent the remainder of his existence in the same wretched condition, became afterwards a model of good conduct and gratitude. Often, in the difficult times of the revolution, he saved the life of Pinel, and on one occasion rescued him from a band of miscreants who were conducting him to the "Lanterne," owing to his having been an elector of 1789. During the time of famine, he left the Bicêtre every morning, and returned with supplies of provisions which gold could not at that time procure. His whole life was one of perpetual devotion to his liberator.

In the course of a few days the shackles were removed from fifty-three lunatics. An unexpected improvement followed from a course previously regarded impracticable and even fatal. The furious madmen, who monthly destroyed hundreds of wooden utensils, renounced their habits of violence; others, who tore their clothes, and rioted in filth and nudity, became clean and decent; tranquillity and harmony succeeded to tumult and disorder; and over the whole establishment order and good feeling reigned.

Yet, although this striking amelioration was accomplished in the metropolis of France, and has been perpetuated and increased by Esquirol and his enlightened fellow labourers; and although in our best institutions in this country a similar wise and benevolent administration exists, it is surprising, that in the provinces of France, as in the interior of the states of this Union, the influence of the example should not have been felt; or, if felt, should have been disregarded.

The extract already given from Dr. Woodward's report exhibits the afflicting truth, that chains and manacles are yet employed as means of restraint; and we have too many reasons to believe, that occasionally the wretched inmates of our almshouses are regarded as little better than the animals with which they are permitted to feed and to congregate.

Even so late as the year 1835, in France—the country of Pinel—it appears from the report of M. Ferrus on the insane, which rests on official documents transmitted to the ministers by the prefects of

police, that chains were still used in some of the country asylums; that at Meréville, in the department of the Vosges, the cages in which the furious maniacs are confined, are in cellars not raised more than a foot above the ground; these cages, made of wood, partly closed, and the remainder open so as to exhibit their interior; their dimensions four feet wide and six deep, receiving light from the openings of the corridors and cellars. Through the bars of those cages, in some of the towns, the miserable occupants receive their straw and food.

Well may we exclaim with M. Pinel, "It is undoubtedly humiliating to be compelled to offer details, which seem to belong to other ages than our own; but publicity being the best remedy for such abuses, we ought not to hesitate to point them out, until they are rectified."

As respects the *third class* of the insane, or those who are confined in the prisons and penitentiaries for safe keeping, enough has already been said. It would require cogent arguments to demonstrate, that, under such circumstances, their mental condition can be ameliorated.

Facts and arguments, similar to those adduced, have led to the establishment of extensive pauper lunatic asylums in Europe, as well as in several states of this Union. The Pauper Lunatic Asylum for the county of Middlesex, at Hanwell, of which Sir W. C. Ellis is the resident medical superintendent, is creditable, in the highest degree to the age and the philanthropy of the country to which it owes its existence. The interior is admirably arranged, and it is surrounded by gardens and cultivated grounds capable of ministering to the physical and moral improvement of the patients. The same may be said of the County Lunatic Asylum at Lancaster, the York County Lunatic Asylum at Wakefield, and others. In the one at Hanwell, the average number of patients was, in 1837, 411 $\frac{149}{365}$; in that of Lancaster, 321; and in that of Wakefield, 608.

It has been well, indeed, observed "that the utility of providing institutions expressly adapted to the insane, for the restoration of the curable, and for the comfort and improvement of the incurable, is so manifest, that we have seldom known the facts presented to a legislative assembly, without their calling forth action on the subject; and the time we trust is not far distant, when a retreat in all civilised countries will be within the reach of every subject of this distressing malady."

In this country much has been done and is yet doing. In Massachusetts there are two institutions, and the citizens of Boston have it in contemplation to establish a third expressly for the city.

The one at Charlestown is, and has been for some time, in successful operation. During the season of 1837 it was enlarged, and will now accomodate 200 patients. The institution at Worcester, Mass., was erected by the state, at an expense of upwards of 50,000 dollars, and will now accommodate 230 persons. It is a state

institution, and is principally filled with those who have committed acts of outrage, or have been adjudged by the courts to be manifestly dangerous to the peace and safety of the community to be at large. All that was contemplated by the state was to put such persons in a place of comparative comfort and security; yet even of these, it would appear from the report of the superintendent, eighty-nine per cent. of cases of less than one year's duration, and more than twenty-five per cent. of old cases have been cured. Both of these are, as the committee of the Legislature of Connecticut remark, "magnificent establishments, and do honour to the state and their founders."

In Maine, the walls of an asylum were partially erected last season on the banks of the Kennebeck, in sight of the State House at Augusta. Thirty-six thousand seven hundred and fifty-five dollars have been expended; and 43,244 dollars is the estimated balance necessary for finishing the building, of which sum 29,500 dollars were appropriated by the legislature at their last session; and it was expected that the walls would be finished, and the roof on, in the autumn of 1838, and that the building will be ready for the reception of patients in the summer or autumn of 1839.

In New Hampshire, energetic measures have been taken to establish an asylum, and at the last meeting of the legislature a bill was reported and passed, one of the leading features of which is, that the state shall subscribe thirty shares of bank stock.

In Vermont a capacious asylum exists on an extensive scale, to which large appropriations have been made by the state. From the first report, submitted to the legislature in October, 1837, it appears, that the number of patients at that time was thirty-four.

The Legislature of Connecticut, as has been before remarked, have the subject before them, and they will doubtless determine not to be behind their neighbours in the race of utility.

New York has made most liberal provision for her insane. The legislature of the state formerly appropriated 10,000 dollars annually for twenty years, for the support of the Asylum for Poor Lunatics at Bloomingdale, near the city of New York. The time is now expired; and the legislature a year ago appropriated 60,000 dollars for the erection of a similar institution in the neighbourhood of Utica. A farm of 120 acres has been purchased in a good state of cultivation and productiveness. Preparations are making for building, and plans have been designed for the accommodation of about 1000 inmates. In addition to these, the city of New York is erecting an extensive asylum for the insane of the city on Blackwell's Island, which, it was supposed, would be so far finished, during the summer of 1838, as to admit of being occupied.

In the Bloomingdale Asylum, 254 patients were treated during the year 1837.

New Jersey likewise is alive to the importance of such an institution, and at the last meeting of the State Medical Society, an address

was made in favour of the measure, and a committee appointed to report at the next meeting.

Virginia possesses two lunatic hospitals, the one situate at Williamsburg, in Eastern Virginia, the other at Staunton, in the Western portion of the state; both have received the anxious attention and aid of the legislature, and at the last session, each obtained appropriations of 30,000 dollars.

South Carolina has expended 100,000 dollars for the erection of a State Asylum at Columbia, and is now making large additions to it. Tennessee has recently erected an asylum at Nashville. Kentucky has hers, on which she has expended 30,000 dollars. The Legislature of Ohio has appropriated 40,000 dollars for erecting an institution at Columbus, which, according to the recent message of the Governor, is in readiness for the reception of patients, and from the numerous applications will not be sufficient for the wants of the state. When finished it will contain 153 rooms, and accommodate 120 patients. Lastly, the Legislative Council of Upper Canada, impressed with the necessity for action, and with the energy that has characterised the philanthropic exertions of many of the states of this Union, to which honourable testimony is borne in the report of their committee, is using active exertions to erect a lunatic asylum in the province.

And what part has this commonwealth, proverbial for her admirable institutions of a charitable nature, taken in this noble career? As yet nothing. She contributed, it is true, towards the erection of the Pennsylvania Hospital; but this valuable charity cannot receive more than 39 poor lunatics; and has, at present, from all parts of the state, but 33, of whom 23 are permanent residents. The new cases are received on trial, and if, after six months, no improvement occurs, their friends are requested to remove them. Even when the new establishment is opened on the western side of the Schuylkill, it is presumed that not more than 50 poor insane persons can be received into it. The time has come, however, when Pennsylvania will arouse her dormant energies, and with her extensive population and territory, and her ample resources, will exhibit that decision which has characterised her in the adoption of every feasible plan for the promotion of the happiness and the amelioration of her citizens. Nor will the contemplated undertaking, except at its commencement, be onerous or expensive. It has been already shown that there are but few insane who cannot be profitably employed in useful, and, we may add, in productive labour. In their present condition, they have to be supported by the community at a higher expense than would be needed in a proper establishment; no facilities are afforded them for appropriate labour, and their maintenance has to be wholly drawn from the district in which relief is extended to them. Add to these considerations, that so many of the recent cases—90 per cent.—are restored, and taking the average of cases 41 per cent., and it will be manifest that the saving in such an asylum might be immense: not only

may the lunatic himself be soon able to quit the institution, but if he be the head of a family, he may thus prevent *them* also from becoming burthensome to the public.

In the county almshouses, it has been shown, no such chance of restoration exists, and evils become perpetuated, which, under other influences, might easily have been rectified.

"By the steward's memoranda," say the trustees of the State Lunatic Hospital at Worcester, Massachusetts, in their fifth annual report, made in Dec. 1837, "it appears that the avails of male labour supplied by the institution, with the aid only of one farmer employed to superintend it, has, at a moderate estimate of the value of the several products, amounted, during the past year, *to more than eleven thousand dollars.* This amount will undoubtedly be increased another year, since we have many more labourers than sufficient to cultivate our land. In addition to the labour employed in farming and gardening, the patients cut and secure all the wood used in the establishment, amounting to more than 400 cords in the year; attend to the barns, stables, and piggeries; perform much of the hard work in washing, and do a great variety of other work about the establishment.

"During the last year we have erected a building containing a shoemaker's shop and a carpenter's shop. In the former we expect hereafter to be able to manufacture and repair all the shoes necessary to supply the hospital, and in the latter to perform much of the work requisite to keep the buildings and furniture in repair. There are some good mechanics amongst our incurable as was as curable patients, and others are capable of being made so notwithstanding their insanity.

"Thus we are enabled to combine profit to the institution with the best and most successful means of cure and enjoyment to its inmates."

The testimony of the steward of the M'Lean Asylum, in his report for the year 1836, is of an analogous nature. After remarking, that in the Labour Department, seventy-seven of the males had been engaged in manual labour, and worked six hours a day—more than which no patient was asked to work—he adds, "Nor has our labour resulted in mere amusement, as the harvest of our crops abundantly testifies. Our farms and lands, inclusive of all the grounds occupied by the buildings and courts, consist of twenty-five acres. We have raised, for the most part, vegetables enough of every kind to supply the institution for the year, and have cut hay sufficient to keep five horses and six cows, besides storing eighty barrels of apples and fifty bushels of pears. We have also made rosewater enough for medicinal and culinary purposes and disposed of fifteen dollars worth. The nett profits of our farm and garden for the past year have been $500.

"Fifty patients have worked in the carpenter's shop at six hours per day, and have been employed 1151 days; and made 7236 boxes, which have been sold for $907 06."

He adds, that it was then sixteen months since a "Sewing Society" had been established amongst the female lunatics, and the avails of their work had been, in cash, $112 96.

Such being the facts in regard to the condition of the insane in this commonwealth, can farther arguments be needed to point out the necessity of an establishment of the kind that is contemplated? Shall we be content with inglorious inactivity, whilst our brethren elsewhere are sedulously employed in their endeavours to restore to mental existence those who are afflicted with the most awful of dispensations, and generally from no fault of their own? Can we remain satisfied with their condition at home in their own miserable hovels, or with banishing them from our sight to be immured in institutions, where but imperfect attempts at restoration are practicable, and where they are merely kept from inflicting injury upon themselves or others, with the moral certainty, in too many of the cases, that hallucinations, which, under other management, might have been wholly removed, must become more and more firmly implanted, until ultimately the wretched maniac sinks prematurely under his excitement, or subsides into a state of incurable melancholy or fatuity? or can we hesitate to exert all our energies to diminish evils of heart-rending extent, and to adopt measures—so eminently within our reach—for restoring the miserable lunatic to his relatives and to his country; or of ameliorating and softening his condition when perfect recovery is impracticable?

Satisfied that only one feeling can prevail upon this deeply interesting and momentous subject, it is but necessary, perhaps, to urge the importance of *speedy* action,—if not on the ground, that already much precious time has been suffered to pass by unimproved, for the overwhelming reason, that every year's delay removes the chance of restoration from hundreds of our fellow creatures, whose reason is, as it were, in our keeping, and lays the foundation of evils which may descend to all future ages.

ON

SPERMATOCELE,

OR

VARIOCELE OF THE SPERMATIC CORD.[1]

BY SIR ASTLEY COOPER, Bart. F. R. S. D. C. L.

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By the above-mentioned terms, I mean to express an enlargement and alteration of structure in the spermatic veins. It is of frequent occurrence, but is sometimes only a slight inconvenience: in other instances, it produces a great deal of local suffering and of mental depression.

Although the veins are generally larger than the arteries in the various structures of the body, yet it appears that the disproportion between them is greater in the spermatic cord and testis than in other organs.

In the erect position of the body they become extremely distended with blood; but in the recumbent posture are comparatively empty; so that they undergo great changes in their bulk from alterations in position, being influenced by the following circumstances:—

1. The height of the column of blood leads to their great distension; for although they possess numerous valves, yet the free lateral communication which exists between them by anastomosing branches, allows the blood to retrograde to the testis through these communicating channels, and to gravitate with force upon the vessels.

2. Under an increase in their diameters, the edges of the valves no longer meet, and the blood descends between them; so that they only partially perform their natural office so long as the enlargement of the veins continues.

3. Relaxation, produced by age or by a warm climate, not only has the effect of relaxing the scrotum, but the veins of the spermatic cord also lose their support from the surrounding parts; and thus is this complaint produced and continued.

4. Clothes worn tight around the abdomen have the effect, by their pressure, of preventing the free return of blood into the inferior cava, from the spermatic veins.

[1] Guy's Hospital Reports, No. vi. p. 1.

The belt also, with which it has been so much the custom to encircle the abdomen, has a strong tendency to produce this effect, as well as, by its pressure upon the abdominal viscera, to force them from their proper cavity; and thus to produce a spermatocele on the one hand, and a hernia on the other; although the belt is sometimes absurdly recommended to prevent both these effects.

5. Corpulency has a similiar tendency to produce spermatocele; for the accumulation of adeps in the omentum and mesentery adds to the pressure upon the returning veins, and leads to the excessive distension of those vessels.

Spermatocele—as every surgeon knows, who is the least familiar with this disease—occurs more frequently in the left than in the right spermatic cord; yet I have several times seen it on the right side; and have a good preparation of it.

The reasons which may be assigned for its greater frequency on the left side, are,

1st, The left testis hangs, in general, lower than the right; and, consequently, the column of blood returning from it is higher than that of the right, and the blood gravitates more powerfully in the erect position of the body.

2dly, The left spermatic vein terminates in the left renal vein, at nearly a right angle to the course of the blood in the two vessels; by which the stream of blood in the spermatic vein is somewhat interrupted, or the freedom of the flow diminished: and the constant operation of this cause produces distension and enlargement of the spermatic vein.

3dly, The renal vein terminates at nearly a right angle with the stream of blood in the inferior cava; and thus a second impediment to the return of the blood is produced from the left testis, whilst the spermatic vein on the right side forms no angles in its course to the vena cava inferior.

4thly, The left renal vein is much exposed to the pressure of the viscera as it crosses the fore-part of the aorta.

That these circumstances do operate to produce spermatocele is proved by its occurrence in the female, in whom it also happens on the left side; and the ovaria being upon the same level, or nearly so, there does not exist a higher column on the left side to produce the effect: yet I have never seen this disease in the female but on the left side; although I do not mean to deny altogether the possibility of its occurring on the right.

Spermatocele produces a pyriform swelling of the spermatic cord; unless it be very pendulous, when it forms a double cone with the testis near the middle; and it may be traced in the inguinal canal, to the upper ring, and even into the abdomen, in relaxed abdominal rings.

The sensation which it gives to the fingers on manipulation, is, that tortuous cords, or small twisted ropes, are contained in the swelling; and the fingers sink between these cords, and meet between them at the back of the scrotum.

In some persons whose skin is thin and delicate, the complaint assumes a bluish appearance; for the colour of the blood appears through the scrotum.

In all persons, it diminishes in the recumbent, and increases in the erect position; and it is lessened by cold, and increased by heat.

In those cases in which the swelling extends into the inguinal canal, it becomes influenced by the action of the abdominal muscles; and coughing or straining produces a sudden increase of the swelling, so as to give it, in that act, a resemblance to hernia, by forcing the blood backwards into the veins.

The testis, in spermatocele, is generally soft and relaxed; and it is somewhat smaller than the other. It also does not fall, as it naturally does, to the bottom of the scrotum, but is suspended about midway between the external ring and the bottom of the scrotum. It hangs anteriorly to the spermatic cord, with what appears like a bundle of twisted and knotted ropes above and below it, reaching to the bottom of the scrotum.

In some persons it is discovered accidentally; but in others, a sense of weight, and feeling of uneasiness in the course of the spermatic cord, lead to a knowledge of its existence by inducing a careful examination of the part.

It sometimes produces a sense of depression in the stomach, and disturbs the digestive process, and thus becomes a great source of annoyance; also, much pain, weight, and uneasiness are produced in the loins.

In some persons the disease occasions a mental depression. The patient believes himself bereft of his virile power; and this impression, with the pain he feels in the part and in the loins, with the weakened powers of digestion, and the influence this produces on the nervous system, leads him to seek assistance which he has not been able to obtain; and he is ready to accede to any proposal for his relief.

In general, however, this complaint produces little inconvenience, and is scarcely heeded by the patient in the greater proportion of cases: and it ought not to depress his spirits, nor is there cause for apprehension, either for the present or for the future.

When spermatocele is dissected, the spermatic veins are found dilated and elongated, and more tortuous than they naturally are: their coats are exceedingly thickened, and they appear to be much more numerous than before the formation of the disease; although this appearance arises only from the increase of the smaller vessels, and not from the production of additional vessels. From the thickening of their coats, the veins appear as arteries when they are cut across; for they remain patulous.

If quicksilver be poured into the vein, at its termination in the renal, it at once descends to the testis, with scarcely any interruption; and the veins can be injected with wax, in a direction contrary to the course of their blood.

From the increase of their diameters, and the valves no longer meeting at their edges, the whole of the blood in the spermatic vein forms a very high perpendicular column, and has a constant tendency to increase the disease.

From their elongation, they become unnaturally tortuous; for they grow in length as well as in diameter.

As this complaint in many respects resembles hernia, and has often led to the improper application of a spring truss, it is necessary to point out the distinction between the two diseases: for the application of a truss not only produces no advantage, but it is, on the contrary, productive of great injury, and increases the complaint, by preventing the return of blood through the veins. However, the mistakes to which I have alluded are very liable to happen, from some of the symptoms being similar in the two diseases.

Like hernia, this complaint begins in the course of the spermatic cord, or at least appears in that course. Like hernia, it increases in the erect, and subsides in the recumbent posture. Like hernia, when it occupies the inguinal canal, it dilates in coughing. Like hernia, it increases by pressure on the abdomen; and, like hernia, it fills from the abdomen when it has been emptied.

But it is unlike hernia, from the irregularity of its surface, and from the feel of tortuous and knotted cords in the swelling: it is unlike intestinal hernia, in the absence of the gurgling noise which attends the return of the intestine into the cavity of the abdomen; and it is unlike the same hernia, in its not inducing an interruption to the passage of the bowels.

But the best discriminating marks are the following:—The patient is desired to place himself in the recumbent posture: then the surgeon presses upon the spermatic cord, and raises the testis and swelling, and it disappears: he then places his fingers at the external abdominal ring, and directs the patient to rise; and if the swelling be varicose, it immediately re-appears; but if it have been hernia, it cannot re-appear. Even pressure at the abdominal ring, without the patient returning to the erect position, will reproduce the swelling of the spermatic veins, by preventing the free return of the blood; but the pressure must not be sufficient to arrest the blood in the spermatic artery, or the veins will remain empty.

Spermatocele might be confounded with congenital hydrocele; as it also fills in the erect, and disappears in the recumbent posture: but the transparency of this hydrocele will lead to a sufficient diagnosis.

OF THE TREATMENT OF SPERMATOCELE.

The applications for a remedy in this complaint are numerous and frequent, and would be abundantly more so, but for the general conviction of the hopelessness of relief.

In general, it is only an inconvenience to the patient; and the plan of treatment consists in supporting the part: and this is effected

by applying a suspensory sling, with two tapes sufficiently long to encircle the abdomen. The sling receives the scrotum and testis; and the tapes, passed around the abdomen, and tied in front, secure the parts in an elevated position. No straps should be placed beneath to pass between the thighs; as they draw back, rather than elevate the scrotum and swelling.

As the parts should be kept as cool as possible, the material of the sling should be an open *silk net*, which allows the escape of heat, and prevents a relaxing perspiration. From this support the patient derives great relief; and the application of an evaporating lotion of spirits of wine and water relieves him still more. A very good lotion for this purpose consists of alumnis ʒi. aquæ ʒxi. spiritus vini ʒi.: but the lotion should be as much as possible devoid of smell, as it leads to the suspicion of some infirmity.

Washing two or three times a day with cold water, with salt dissolved in it, is useful; and the employment of the shower bath, by constringing the scrotum, prevents the increase of the complaint.

The dress should be as light as possible, to prevent the production of superfluous heat, and to permit its escape; and all tight dress around the abdomen is to be avoided, to allow of the free return of the venous blood from the testis. Still, however, these means leave the patient with the badge of his infirmity, from his continuing to wear his bandage; and attempts have been made to relieve him by exciting inflammation and thickening of the scrotum, and thus to render it a better support to the testes. I have applied the pyroligneous acid for this purpose; but the pain which it excited was severe, and the good effect only temporary. I have also employed blisters with the same view and with the same effect.

It has been advised to draw the scrotum through a ring, and fix it there, the person continuing to wear it; but, as it may be readily believed, this has no advantage over the use of the sling support, and is a much greater annoyance to the patient's feelings, either than the disease itself, or the bandage which he is usually called upon to wear.

Yet there are cases in which this complaint produces so much pain of body and mental distress, as to render it absolutely necessary to do something more than is generally advised. The patient has constant pain, and a feeling of weight in the scrotum, which leads him to support it with his hand, and frequently to change the position of the parts. He suffers much in exercise, both in riding and walking; and he has pain in the course of the spermatic cord, and in the loins on that side. He has a sinking sensation at his stomach; his mind is never free from anxiety and depression, from a belief that his powers are diminished; and his life is rendered miserable. The complaint is no longer a simple inconvenience, but is a source of constant annoyance, and he most eagerly seeks some mode of relief. In such severe cases, the patient is sometimes anxious for the removal of the testis, as he does not regard the pain

of an operation, when contrasted with the constant uneasiness which he suffers. Of this I will give the following case, from an operation on a patient in Guy's Hospital, performed by Mr. Key.

"T. H., aged 18 years, was admitted into Guy's Hospital, under my care, in June 1826, for an enlargement of the veins of the spermatic cord, accompanied with considerable pain.

"About three years ago, whilst he was in the act of mounting a horse, the animal sprang forward, and on his descent upon the saddle, the left testicle was much bruised, and produced, for a few minutes, excruciating pain. In a fortnight, the effects of the accident had nearly subsided; but from this time he remarked that the testicle felt softer than the other, and occasionally gave him pain along the cord; and he also imagined that the gland gradually wasted. Till within the last six months, it did not give him much inconvenience; but latterly it has begun to swell, and has become more painful when he has been engaged in any active employment. The part now presents an irregular knotty swelling at the superior and back part of the testis, extending some way up the cord; and it conveys to the hand the impression of a bundle of cords, with knots tied in them. The testicle is soft, and not so large as the other, and gives when handled. The pain is chiefly referred to the loins.

"The swelling in the veins has the usual characters of hernia; dilating upon coughing, and increasing in the erect position of the body.

"At his earnest request, the operation of removing the testicle was performed, after the ineffectual application of sedative local remedies, leeches, and a continued horizontal posture, with alterative medicines. It was at one time suggested that a ligature on the spermatic vein might succeed in curing the varicocele; but the natural irritability of the patient's constitution forbade such an operation.

"Charles Aston Key."

Although the foregoing is a most severe case, and of rare occurrence in so aggravated a degree, yet I have seen, in the course of my practice, many persons suffer so severely in body and in mind from this complaint, that they would readily submit to any operation which was not attended with danger to life, to obtain relief. As to tying the veins of the spermatic cord—from what I have seen of the dangerous and destructive effect of exciting inflammation in veins—I should never propose it; nor do I think, if it were not dangerous, that it is founded on proper principles. But, in my work on the testis, published in the year 1830, I have advised the removal of a portion of the scrotum in the following words:—

"The removal of a portion of the scrotum will lead to a diminution of the veins of the spermatic cord; and it is an operation, in

an extreme enlargement accompanied with pain, which might be tried with perfect safety, and is very likely to succeed."

I had, at that time, never performed the operation, and I therefore spoke of the probability of success only: but, aware of its being free from danger, and seeing that it would render the remaining portion of the scrotum a natural bandage, and that a great degree of relaxation of the scrotum also attended this complaint, and that such relaxed portion might be safely and effectually removed, I determined to take some opportunity of performing the operation.

Beside the advantage of making the scrotum, in its lessened state, a means of support, it must naturally occur, that the adhesion, excited by the operation of the fascia, which covers the cremaster, to the surrounding parts, would produce a permanent support, and render a suspensory bandage unnecessary. It might be thought a painful operation; but it is not so, nor does it excite constitutional irritation.

The mode of performing it is as follows:—The patient being placed in the recumbent posture, the relaxed scrotum is drawn between the fingers; the testis is to be raised to the external ring by an assistant; and then the portion of the scrotum is removed by the knife or knife-scissors;—but I prefer the former. Any artery of the scrotum which bleeds is to be tied; and a suture is then made, to bring the edges of the diminished scrotum together. The patient should be kept for a few hours in the recumbent posture, to prevent any tendency to bleeding; and then a suspensory bag is to be applied, to press the testis upwards, and to glue the scrotum to the surface.

The only difficulty in the operation of removing the scrotum by excision, is in ascertaining the proper quantity to be removed; but it adds but little to the pain if a second portion be taken away, if the first does not make sufficient pressure on the spermatic cord. It is of no use to remove a small portion of the scrotum, for from doing this I have failed. When the wound has healed, the varicocele is lessened, but not always entirely removed; but the pain and distressing sensations cease, if sufficient of the scrotum be removed.

In making the suture in the scrotum, its lower part is to be brought up towards the abdominal ring, to raise and support the testis; as does the suspensory sling when it is worn.

CASES.

Case 1.—Mr. Rees, surgeon, of Blackfriars Road, sent me a patient of his, who had a large varicocele on the left side, with a very relaxed scrotum. He suffered severely from uneasiness in the spermatic cord and in the loins, a sense of weight and oppression in the region of the stomach, and excessive mental depression. On the 18th of February, 1831, I removed a large portion of the scrotum, and exposed the fascia covering the cremaster, and the testis in its envelopes. By three sutures, the edges of the scrotum were

approximated, and the wound quickly healed, and he, on the 3d of March afterwards, quitted London. Through the kindness of Mr. Rees and Mr. Webster, I have received the following account of the result of the operation :—

"Dear Sir—The gentleman on whom you operated was 32 years of age. The portion of the scrotum removed, when extended, measured four inches in length, and in breadth, in the middle, two inches and a half. He left London perfectly well, and I have sent you his address.

"I am your obedient servant,

"John Rees.

"240, Blackfriars Road."

From Mr. Webster I have since learned the following particulars :—

"The gentleman is able to ride fifty miles a day, without inconvenience; although, before the operation, he could not continue on horseback more than two or three miles: and in a letter which Mr. Rees has received from him, he expresses himself in the highest terms of gratitude for his recovery."

Case 2.—Mr. S——, aged 20, has had a spermatocele three years and a half, attended with a great sense of uneasiness in the part, and a dull, heavy pain in the spermatic cord and loin on that side. My assistant, Mr. Balderson, held the scrotum between his fingers, and I removed all that could be easily elevated from the testis and its coverings, which are necessarily exposed in the operation. I then brought the integuments together by sutures, so as to close the wound completely; but I previously secured some small bleeding arteries. He was ordered to keep himself cool, and to remain in the recumbent posture; and the part was placed in a suspensory sling: however, the next morning he went down to breakfast; but this imprudence did not prevent his quick recovery from the operation, with the result of which he was highly pleased. The varicose veins are greatly reduced: the coverings of the testis adhere to the upper part of the scrotum. He soon gave up the use of the sling support; and lost the pain in the spermatic cord and loins, which he had previously sustained.

Case 3.—H. B., aged 18 years, had a spermatocele upon the left side, from the age of fourteen. At fifteen he fell across an iron bar, which greatly hurt him; and he thought the complaint had quickly increased after that time. He suffered much from pain in the testis, more especially in walking, and from uneasiness in the groin, spermatic cord, and the spinous process of the ilium and loins. He consulted several medical men, who told him his complaint was a hernia. But he was then recommended to Mr. Taunton, in Hatton Garden, who informed him it was a varicocele: and the scrotum was directed to be supported, and an evaporating lotion to be used.

On July 20, 1837, I removed a large portion of the relaxed scrotum which covered the swelling, in the presence of Mr. James Babington; secured some small arteries, and then used four sutures to approximate the edges of the scrotum. He was sent from my house, in a coach, to Chelsea, after the operation; and the scrotum very soon healed, and the uneasy sensation in the part vanished.

Case 4.—Mr. John K——, aged 25, four months ago found the scrotum enlarged on the left side, with occasional pain in the part, which darted upwards to the external abdominal ring. It gradually increased, until it was three times larger than the right side of the scrotum, became more painful, and occasioned much depression of spirits. On the 15th of October, 1837, I removed a portion of the scrotum by passing a needle and thread through it in three different places, and cutting away the scrotum beyond them. This plan did not facilitate the operation, and made the tying of the arteries more difficult; but it succeeded in relieving the disease.

I am obliged to Mr. Key for sending me the following case.

"In the autumn of 1837, a young man, aged 18, suffering much from a painful varicocele, applied to me, to know if I would advise him to submit to the operation of tying the veins, which had been recommended by a surgeon. The varicocele, which was on the left side, was large, and more than usually pendulous; the veins forming a large festoon, that could be distinctly felt through the scrotum. I explained to him the risk and inefficacy of an operation on the veins, and also the simple operation which you had practised for the cure of varicocele. The pain that he experienced in following his occupation induced him, at once, to have the operation performed. With the assistance of my dresser, Mr. Whitchurch, I removed about two inches of skin, so as to shorten the scrotum from above to below. The edges of the wound were secured by pins; but an oozing of blood into the cellular membrane interfered with the process of adhesion, and the whole healed by granulation. The relief which he thus obtained, since the wound closed, will induce me to have recourse in future to the operation for a painful varicocele. The support which the veins would have received if the wound had healed by adhesion would have been more effectual; and I should in another case take every precaution to ensure the adhesive process."

In one case I raised the scrotum and placed a ligature around the part which I designed to remove, drawing the thread quite tight: but it produced a great deal of pain; the part sloughed with considerable constitutional irritation, and after a great length of time, and with more suffering than the complaint justifies.

I wish it to be recollected, that I only recommend the removal of a portion of the scrotum in those cases of spermatocele in which the patient suffers great local pain; in cases in which he is most urgent to have the swelling and deformity of the part removed,

and more especially in those instances in which the function of digestion suffers, and there is a degree of nervousness and of mental depression. For slighter cases, a suspensory bandage must be still recommended.